SOIL SCIENCE AND CONSERVATION

TO ADVANCE THE ART AND SCIENCE OF SOIL AND WATER CONSERVATION

Volume 15, No. 4

July • 1960

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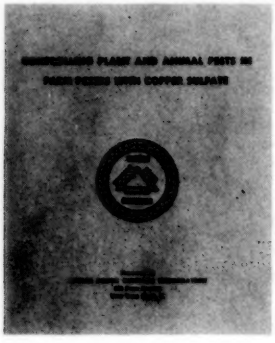

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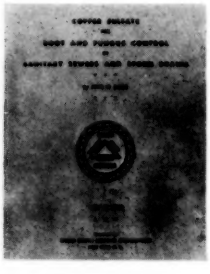

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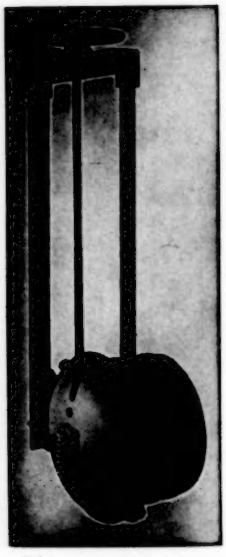

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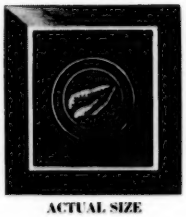

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VOLUME 15
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Soil scientist Tom Lane, member of The Ontario Chapter, Soil Conservation Society of America, Canada, discusses soil conservation with a farmer and his son.

Photo Courtesy Conservation Branch, Ontario Department of Planning and Development, Ontario, Canada

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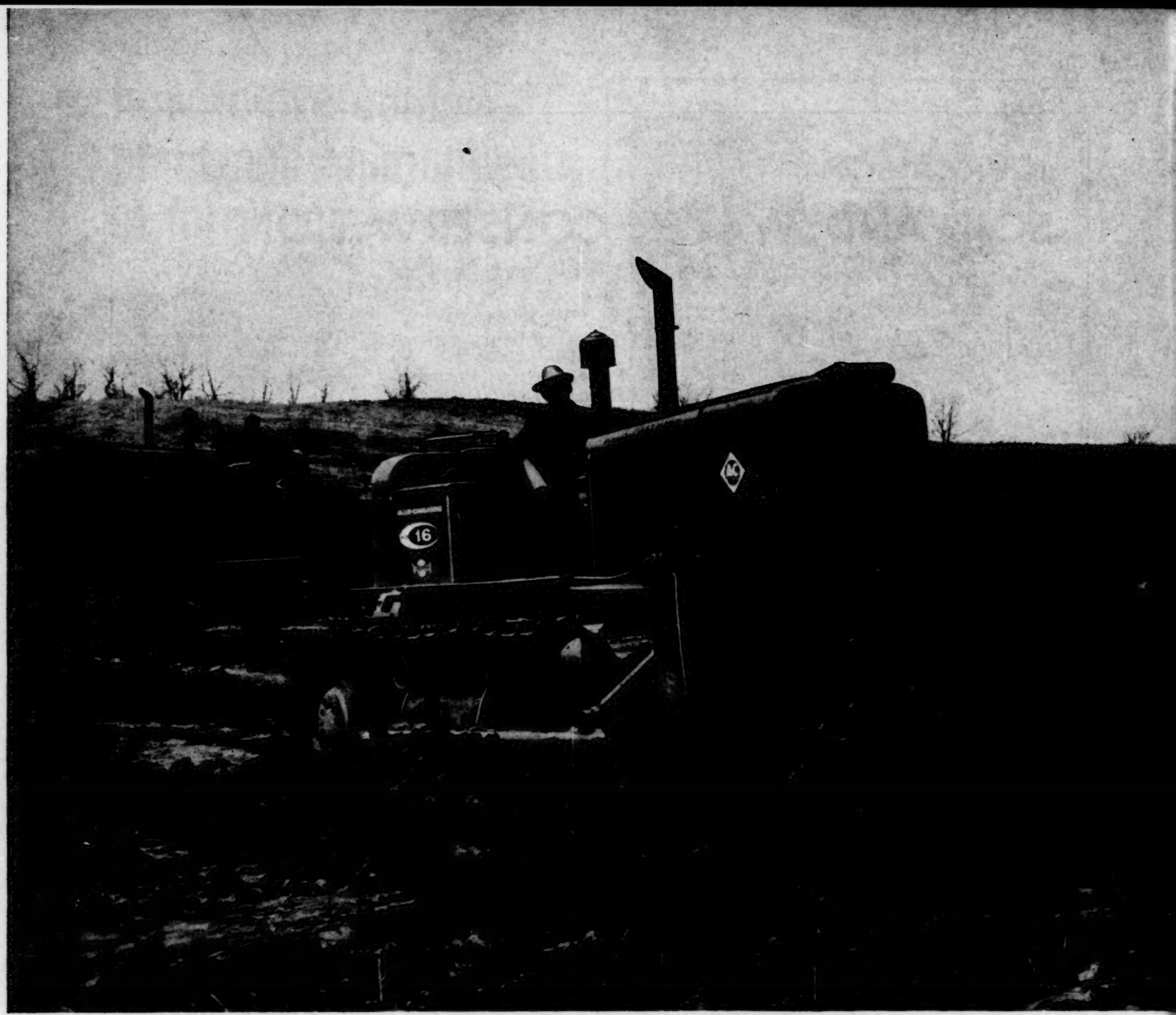

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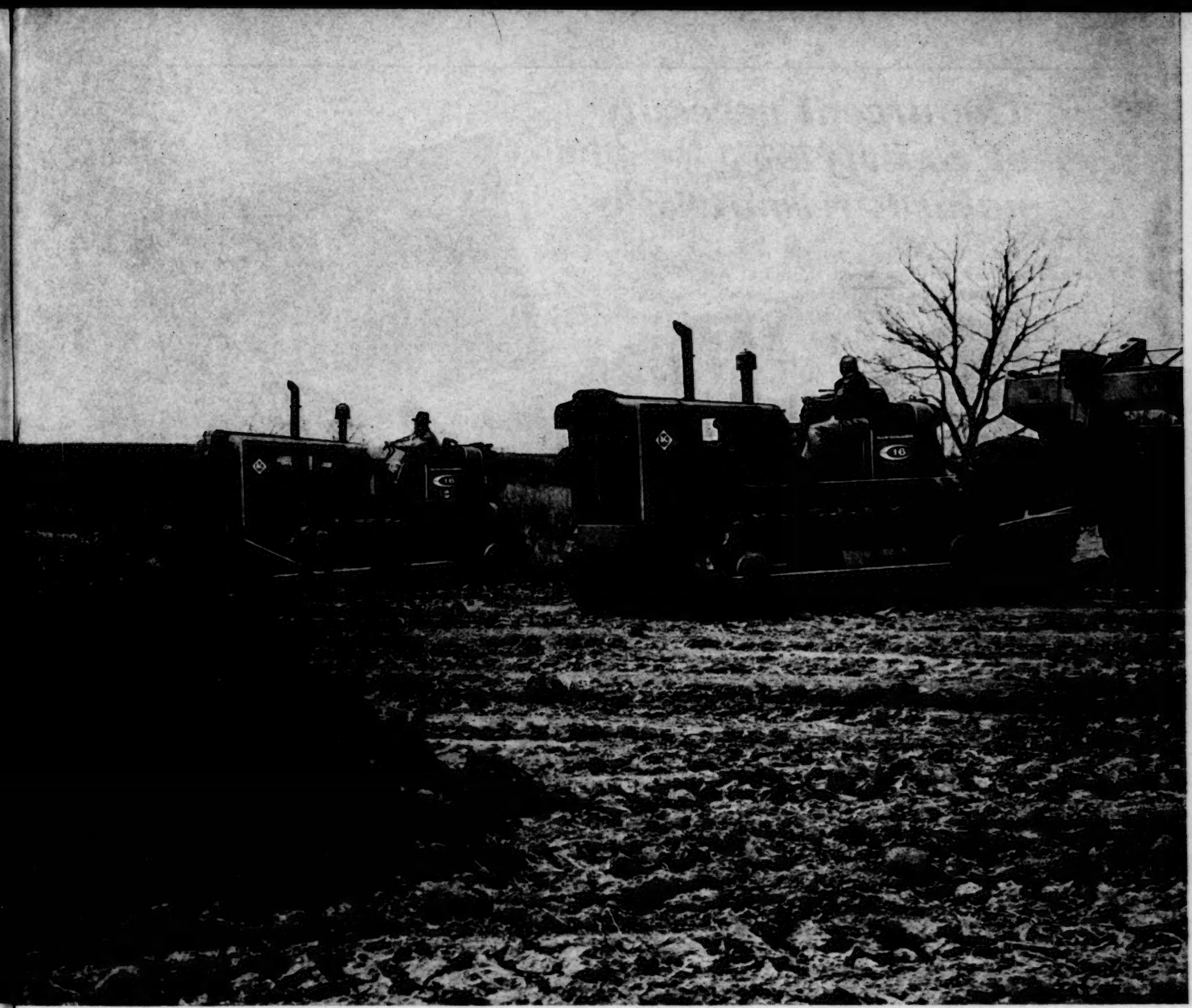

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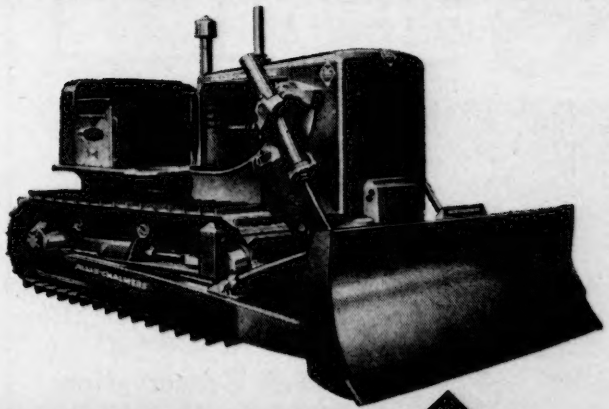

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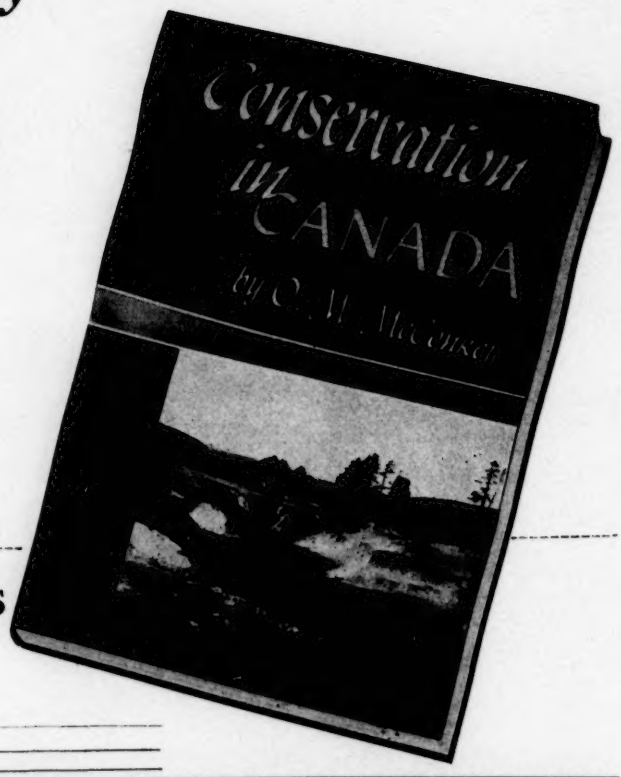

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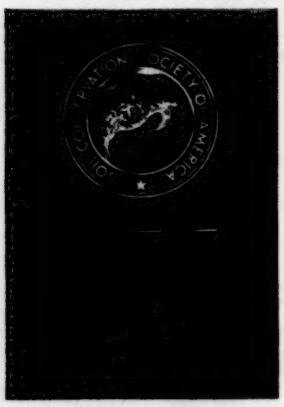

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The Political and Economic Framework of Water Resource Development Research

FREDERIC O. SARGENT

PROBLEMS OF WATER DEVELOPMENT AND CONTROL must be studied and solved within a framework that is both political and economic. It is necessary therefore, to understand the nature of both of these disciplines as they relate to water resources and the relationship of each to the other. The purpose of this paper is to describe the nature of the relationship between the political and economic frameworks of water resource development problems. In order to accomplish this task, it will first be necessary to discuss two methods of resource allocation—one economic and one political. Secondly, we will look at goals from these two points of view. Thirdly, notice must be taken of the special characteristics of water and, finally, the significance of the simultaneous existence of two analytical frameworks[1] will be considered.

1. Methods of Resource Allocation

In order to analyze problems concerning water resource development, it is necessary to consider the ways in which resources are allocated. All resources are allocated under one of the following methods or some combination of them: (1) by following customs, (2) by decisions of authorities, (3) by people buying with dollars in the market place, and (4) by people voting with ballots at the polls.

Allocations which are determined by authorities and those made by custom may be omitted from this discussion, as their importance is limited. The discussion then narrows to two principal methods of resource allocation—by buying and by voting, i.e., price allocation in the market and vote allocation in the legislature[2]—the economic and the political allocating systems.

The economic or market allocations are made by people who make purchases in the market place. Consumers register preferences for one product over another through their purchases of the favored product. In the process of satisfying that consumer demand, producers allocate resources, through their purchases of raw materials required to produce the desired product. This choice-indicating and resource-allocating process is the basis of contemporary economic price theory.

Dr. Frederic O. Sargent is associate professor in the Department of Agricultural Economics, Ontario Agricultural College, Guelph, Ontario. *Helpful suggestions made by A. B. Kennerly are gratefully acknowledged.*

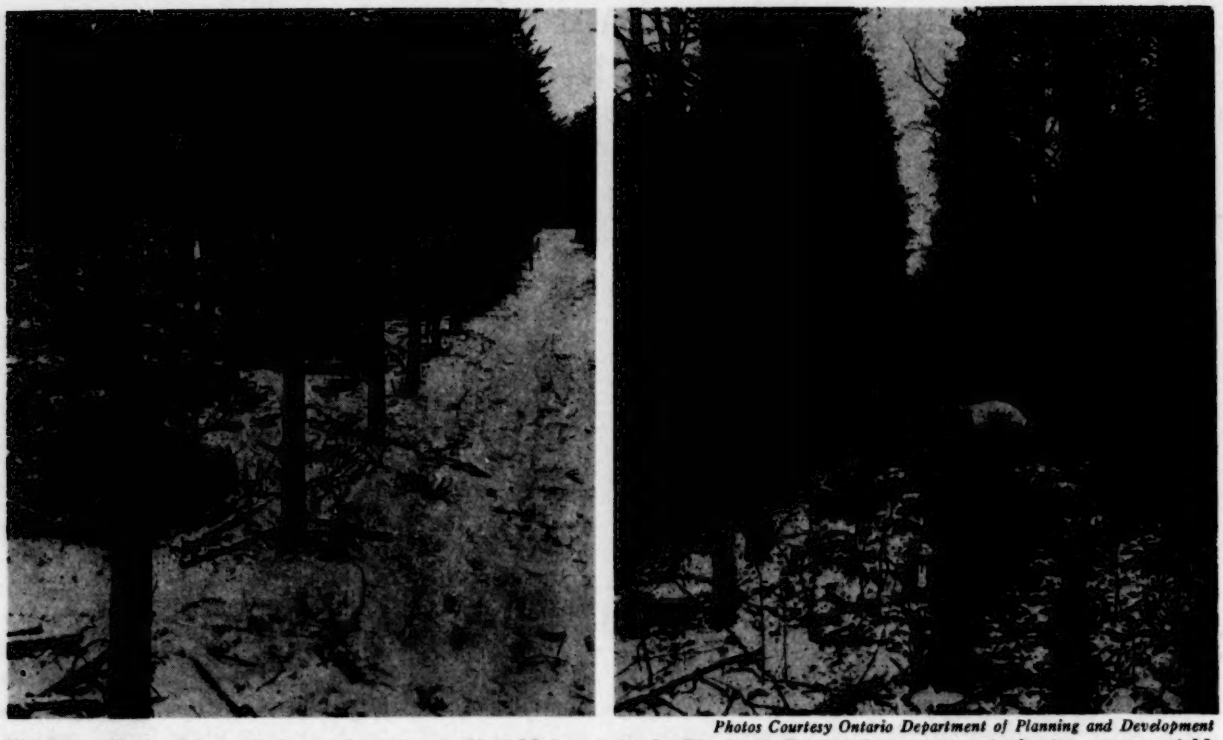
The political system provides another resource allocating process. Resources are allocated by legislators when they vote for and pass laws which state definite objectives concerning resources, appropriate funds, and provide for a means for achieving the objectives. Further allocations within the political systems may be made by judges and administrators when they interpret the legislatures' statutes through judicial opinions and administration directives.

Although the final allocative decision is made by the legislators, judges, or administrators, the resource allocating process includes all the discussions and debates in public meetings, in columns of newspapers and among neighbors, which takes place prior to the formal political process. Just as the preference indicator and resource allocation method which operate in the market place constitute the core of economic price theory, so the choice indicator and resource allocation process which operate through political institutions constitute the core of the political resource allocating theory.[3]

These two resource allocating processes refer to two distinctly different types of problems. The market allocation of resources is generally associated with private ownership of resources, with the production of consumer goods, and with the production of capital equipment necessary for producing consumer goods.

The legislative allocation of resources is associated with a number of situations which may be classified into four type situations. The four type situations are:

1. Government-owned resources are allocated by the government units which own and control the resource. This type of political allocation is of importance in western states (U.S.A.) where the amount of land that is controlled by the political institutions is nearly 50 per cent of the total land area. Also, it is important in water resource development programs as water and water courses are usually owned by state governments and their appropriation and use controlled by state statutes.
2. Resources necessary for the attainment of paramount public goals are allocated through the political process. Land needed to construct a reservoir



Photos Courtesy Ontario Department of Planning and Development

Figure 1. Many of the early forest plantations in Norfold County in the Big Creek Region Conservation Authority are now yielding returns in the form of poles, pit props and pulpwood. Thinning from the 25-year-old red pine plantation on the *left* yielded a net return of $100 per acre. The 30-year-old jack pine plantation on the *right* is being thinned for pulpwood.

or dam site for public purposes is taken by the federal or state government, or their agencies, under the right of eminent domain.

3. Resources required for regional development projects are allocated through the political process when the scope of the development is in excess of what would be feasible for private enterprise to undertake. A multiple-purpose development program such as the Tennessee Valley Authority must be built by a public authority, as many of its aspects are not profit oriented (e.g., flood control, soil conservation, malaria eradication), and so beyond the scope of private enterprise.
4. Scarce resources which are considered to be essential for life must be allocated or rationed by political institutions. Water in an area where the supply is relatively short in relation to need and accustomed rate of use is usually rationed by a government authority under police power.

2. Goals of Resource Development

All goals concerning resource development may be divided into two categories—private and public. Private economic goals are the goals set by individual entrepreneurs, by owners and managers of business firms. In economic theory, private goals are usually assumed to be the maximization of profit. Other goals such as minimizing losses or maintaining good will are also encompassed in micro-economic theory. There are no private goals in political economy as this field is a study of groups organized and participating in the political process.

Public goals are the resultant of the competition among the goals of all of the organized economic groups in the body politic.[4] Public goals have both an economic and a political aspect. In a major program of water resources development for instance, the public goals might include the following: (1) to control floods, (2) to develop irrigation, (3) to supply water to municipalities, (4) to provide transportation, (5) to provide habitat for wildlife and aquatic life, (6) to provide recreational facilities, (7) to supply water to industry, (8) to dispose of domestic and industrial wastes; and (9) to produce electricity. Each of these goals is a public goal as a group of citizens with a common *economic* interest is organized to support and promote that interest in the *political* arena.[5]

Even though public goals are based on and derived from private goals, they are clearly distinct from private goals. Private goals concern individual firms; public goals concern organized groups of people. Private goals are achieved by private planning, investing, management; and activities in product and factor markets. Public goals are achieved through public planning,

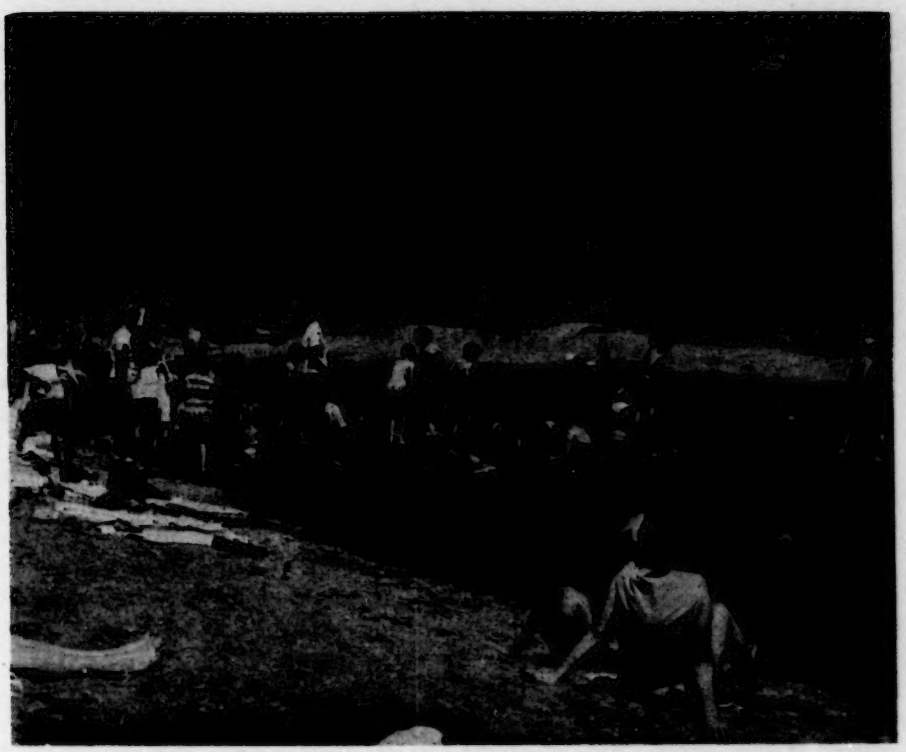


Figure 2. Water recreation facility in Boyd Conservation Area developed by Metropolitan Toronto & Region Conservation Authority. As many as 6,500 people visit this area on a warm summer day.

Photo by Leo Pylawsky

legislative enactments, legislative appropriations, judicial decisions and the actions of public administrators.

General and Specific Public Goals

All public goals may be further divided into two classes, with respect to the degree of abstraction of the concept concerned. One class consists of goals which are *abstract, general, ultimate,* or *theoretical.* The other category consists of goals which are *concrete, specific, immediate,* or *practical* An example of a general goal is the goal of "full development of water resources." A specific goal is the goal to build a dam at Ferguson's Crossing. General goals are goals which must be further defined in terms of specific situations before they take on an objective meaning, i.e., a meaning which several people can understand in the same way. For instance there is general agreement on the general goal of "full development of water resources." However, what this term means to people with various economic interests would vary according to those interests in a specific situation. Some people would say that this general goal may be implemented by constructing a dam at Ferguson's Crossing. Others would say, "No—this general goal can be implemented by pursuing the specific goal of constructing a dam at Roger's Creek." In either case the specific goals are sufficiently definite to permit all interested parties to determine their interests in the proposal.[6]

This duality of goals is of critical importance because it involves acts of valuation. A value judgment is involved when one translates a general goal into a specific goal. In order to interpret the general goal of "full development of water resources" into terms of a specific goal such as a dam on Roger's Creek, it is necessary for the interpreter to make a value judgment to the effect that the constructors of a dam on Roger's Creek will contribute to the general goal of "full water resource development." Another person with different interests might use a different value judgment, make a different interpretation, and say that the general goal would better be obtained by locating the dam at a different place. Although there may be agreement on the general goal of "full" development, different *economic* interests and different value judgments may lead to diametrically opposed specific goals concerning the project required to bring about "full" development.

This distinction between general goals and specific goals is of critical importance as all tools of economic analysis designed for use in problem-solving assume that goals are specific in nature. General goals are not definable in terms which a large number of people will agree upon. Hence, they are not precision concepts of the type necessary for economic analysis, planning or research. On the other hand, specific goals *are* amenable to use with the tools of economic analyses and research. It would be conceptually difficult, for instance, for an economist to say what would promote a general goal such as "the maximum economic development of a watershed." On the other hand it would be possible for him

to state how a municipality could obtain a certain quantity of water most economically.

There is no suggestion here that abstract or general goals are unimportant. They are as important in our culture as the specific goals. It is necessary to understand the process by which individuals, economic interest groups and legislators move from abstract goals to specific goals in order to discover the starting point for economic research on complex problems and in order to focus the research on the strategic aspects of a situation.

The Determination of Specific Public Goals

The formation of specific goals is accomplished by groups of people organized on the basis of common economic interests communicating through political institutions to legislators who enact statutes. Each economic-interest group is a sector of the political economy and its goal may become a part of the public goals. For instance, the farmers in the lower valley of the Red River want more water for irrigation. They organize and proceed to explain their interests to local voters and legislators. A group of consumers of electricity in the same watershed may argue that the public interest can better be served by the production of low-cost power. The consumers will try to influence the electorate and other political agencies to promote hydro-electric power development. A third group may wish to have a reservoir built to provide recreational facilities which will enhance land values. This group will try to influence legislators according to this interest. A large number of other special-interest groups also will organize to promote specific goals. Municipalities, conservationists, the Corps of Army Engineers, power companies, chambers of commerce, and other groups will make their interpretation of the specific goals required to implement the general goal of maximizing water resource development. Each group will present and argue its case through conventional political institutions. To parallel the level of abstraction used in economic terminology, we would say that under conditions of "pure and perfect" legislation the law that results from this process will maximize social satisfaction. *In practice, legislatures are probably as efficient in allocating resources in accord with public demands as markets are in reflecting consumer demands.*

Conflicts Among Goals

Both economic and political resource development research would be simple if public goals came ready-ordered into a neat hierarchy. Such is not the case. Public goals are invariably multiple, often conflicting, and frequently diametrically opposed.

There are three approaches which researchers may take in situations of multiple or conflicting public goals. The researcher may (1) solve the problem by assumption, (2) arbitrate the disagreement over goals, or (3) investigate the problem further to find an ordering among the goals.

The question of goals is solved by assumption when an assumption is made that "everyone favors wildlife conservation" or any other specific goal. Arbitration of conflicts over goals is conducted by mediators. The science and art of collective bargaining is based on this approach. A third approach by political economists is to investigate goals. Goals may be investigated by use of the same techniques employed in the study of any other social science phenome-

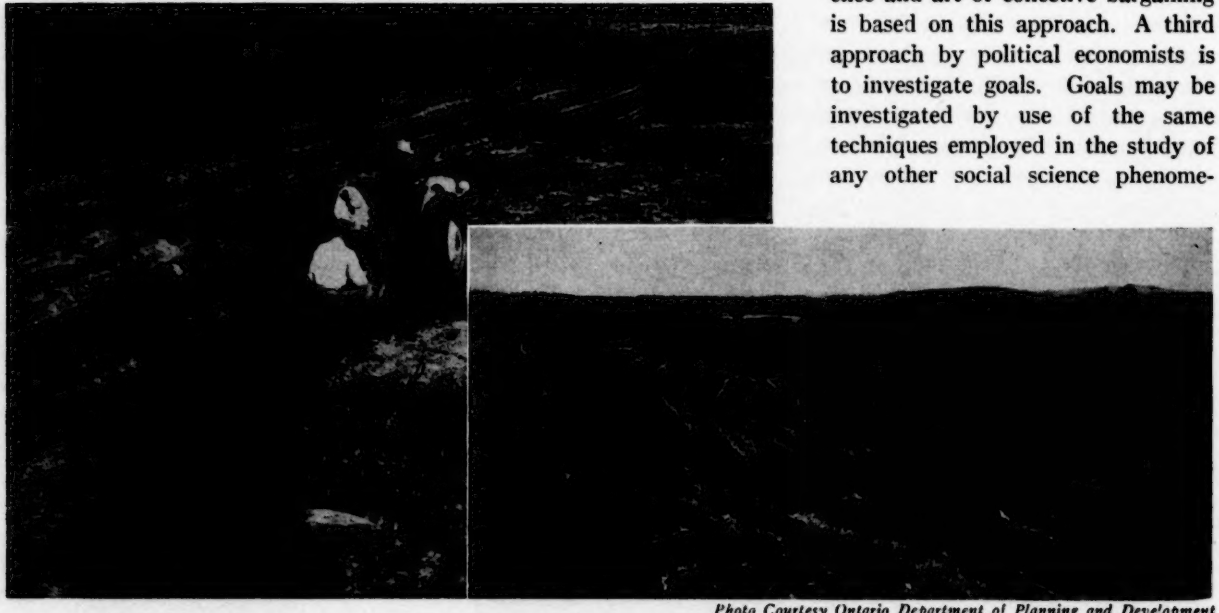


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Figure 3. ***Right.*** **Boy Scouts by the hundreds assist in tree planting on the contour under the auspices of the Ontario River Valley Authority.** ***Left.*** **Under its private reforestation assistance program the Grand Valley Conservation Authority planted 348,00 trees in the spring of 1959. The equipment and two men are supplied free of charge provided the owner agrees to maintain and protect his plantation.**

non. It requires special training, experience, and know-how to identify and categorize the multiplicity of public economic interests, but these special analytical techniques are now fairly well developed and are employed with a high degree of success.

3. Unique Characteristics of Water

Water resources have four unique characteristics which limit the nature of analytical tools which may be used in analysis of water problems. In the first place, water is generally characterized by group ownership. This is generally true wherever water is scarce. Ownership is often divided among the federal government, the state governments, and local associations and sub-divisions of state government.

Another important characteristic of water is that it can be changed from an economic good to a disutility by a change in the supply. In time of flood, water becomes a public menace and must be treated like an invading army of an enemy nation, i.e., the threat must be alleviated without immediate concern over costs. Problems of allocating costs of flood prevention specifically to individuals or units of government become secondary to the task of flood prevention itself.

Another aspect of water resources is that most of the many projects for the development of resources must be carried out on such a large scale that it is necessary for the state or federal government to provide assistance in planning and financing. This is necessitated not only by the scale of water resource development projects, but also by the fact that water is associated with so many uses, some of which, such as flood control, sewage disposal, malaria eradication, are not profit producing or profit orientated.

4. Implications for Economic Research

- Water is generally allocated by the political system.
- Water resource development goals are characteristically multiple and conflicting.
- Water is significantly different from other economic goods in critical ways.

These facts necessitate the use of special research techniques in the study of water problems. Analytical tehniques applicable to business firms that buy and sell in a market economy, that seek to maximize profits, are understandably inadequate in the study of a resource such as water. Water is less influenced by prices of factors or products. Water has a number of simultaneously conflicting uses, both private and social, and it can become a public nuisance or scourge with a change in supply.

The fact of legislative allocation of water resources requires that economic analysis be conducted within a dominant political framework. The function of the economist becomes that of evaluating benefits, costs and incidence of costs of alternatives proposed within the political framework or ones which are sufficiently feasible to be proposed. A municipality, for instance, in considering the installation of a water supply system, is not concerned with alternative investment opportunities but rather in the lowest-cost politically-acceptable way to achieve the goal specified by the tax-paying voters in their vote for a water bond issue. The allocation of water for municipal use is determined by the voters before an analysis is made of the least cost method of supplying water.

The multiplicity of goals and the unique characteristics of water present additional special problems not encountered in analyses in which goals are simple and assumed to be given. To handle this problem the economist must commence his research with an investigation and evaluation of the goals held by various groups. To do this it is useful first to identify the economic and special interest groups as well as the various levels of taxpayers and voters who may have a direct or an indirect interest. After identifying the various "publics" it is necessary to weigh each in terms of political influence, numbers, and direct and indirect monetary interest in terms of taxes, investment and benefits. This is a complicated process but the methodology of this type of analysis has been worked out in considerable detail until it is now fairly routine for those with specialized training.

The end product of research in water resource development problems is often quite different from the end product in other, more conventional, types of economic analysis. The actual nature of the research product will depend upon the situation. It may take the form of an analysis of the economic implications of proposed programs or schemes. It may take the form of a new policy proposal suggested by an examination of the nature of goals held by interested groups and the potential for development of the resource base. The economist, if successful, may become involved in the planning process as an "expert". His research product, then, will be indistinguishable from the contributions of the many other professional planners. In any case his contribution will be in the nature of critical appraisals of proposed plans, studies of analogous situations, suggestions of new legislation to change the framework of resource allocation or economic analyses of administration procedures and programs.

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[1] This paper is addressed to some of the major theoretical issues concerning the applicable theoretical framework for the analysis of water resource development problems. These issues have been discussed and debated extensively by agricultural economists and others in books, journals, and conferences. As examples of this debate see: W. L. McPhersen and Raleigh Barlowe, "Can Water Be Allocated by Competitive Prices?" *Journal*

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Surface Runoff and Erosion— Related Problems of Timber Harvesting

NEDAVIA BETHLAHMY

Summary

Logging affects the hydrologic characteristics and behavior of watersheds. The effects may be severe or light depending upon the methods used, the degree of planning, and the attention paid to details in execution. Roads for logging are a prime source of erosion and contribute directly to stream siltation. Roads for skidding likewise are responsible for such damages, but possibly to a lesser extent. The harmful effects of all roads can be minimized by good planning. Animal, tractor, and cable logging affect the land surface in different degrees of severity. The effects of tractor logging may be particularly severe in mountainous terrain. Research is needed to define the type of logging best suited to a particular site and to innovate improved logging methods. Controlled burning to eliminate logging debris cannot be condemned wholesale; additional research is needed to fully assess the total effect of this practice.

EARLY LOGGING usually took place on gentle terrain, so that erosion damages were negligible. Modern machinery has made formerly difficult logging sites accessible, and these steep areas, stripped of their forest cover, are no longer immune to nature's erosive forces. Early-day bull teams had a fierce appearance, but they could not wreak the land damage that one crawler tractor can effect in a short hour's work; and early logging railroads, with gentle grades and tracks spiked to wooden crossties to absorb the shock of rolling wheels, had a minor hydrologic effect compared to modern logging roads traversing steep terrain and being pounded by the wheels of moving trucks.

What are some of the effects of modern timber harvesting methods? What problems do they pose and what solutions are possible?

Logging Methods

Two basically different types of logging are now practiced. In one, a mobile source of power is used to haul logs to a landing (loading area), whereas in the other a fixed source of power is used in conjunction with cables. Ground skidding by horses and tractors are examples of mobile sources of power, whereas donkeys (the logger's term for a fixed engine) hauling cables on or above the ground illustrate the use of a fixed source of power.

Dr. Bethlahmy is research forester with the Pacific Northwest Forest & Range Experiment Station, Forest Service, U. S. Dept. of Agriculture, Portland, Oregon.

Bullwhacks are no longer a part of the American logging scene. And the skid-greaser, whose job was to grease the skids over which logs were hauled, is now only a fond memory of a bygone age. Logging railroads have also passed out of the picture, although teamsters urging their straining horses may still be found here and there. In present-day logging operations, huge tractors and road-building machinery are the rule, rather than the exception. The introduction and expanded use of these machines has been a boon to the logging industry, but has brought in its wake many problems that are of great concern to land managers and those concerned with our water resources.

Cable Logging

From its early, simple beginnings, the cable system has evolved into highly complex and efficient variations. In the earliest system (ground-line cable) the log was attached to a cable and hauled over the ground to the landing site. As the log was pulled over the ground, it gouged a trough in which surface runoff concentrated. This system was eventually abandoned in favor of more efficient cable methods.

In one of the cable system variations (high-lead system), the cable is pulled through a block attached near the top of a 150- to 200-foot "spar" tree. Again, as in the previous system, as logs are pulled toward the spar tree, troughs are formed (some shallow, others deep) in which the soil tends to become compacted and in which surface runoff is concentrated. As a result, the drainage characteristics of the area are modified, although the extent of this change is not known.

One essential characteristic of the high-lead system is responsible for some differences in land damages as compared to the ground-line system. Because the cable is attached at a considerable height above ground, a lifting force is exerted on the log over a big part of the skidding distance, and the log is not likely to gouge out as deep a channel as when pulled by a cable parallel to the ground. Moreover, since the logs are generally pulled

Figure 1. Scenes like this were common in the early days of logging in the Pacific Northwest. Erosion was not a serious problem.

uphill toward the spar tree, the channels fan out, thereby tending to spread the water concentrated in them.

Other variations of the cable system include methods in which cables are strung high above the ground between two spar trees (skyline system), and the logs are lifted relatively close to where the trees were felled and are transported to the landing with very little ground contact. Obviously, this system keeps soil damage at a minimum.

Tractor Logging

Whenever mobile sources of power are used, the logs are generally dragged to the landings over a network of routes called skid roads. What is the hydrologic importance of these skid roads? One study (9) showed that such roads occupied 26 per cent of the logging area. Moreover, permeability rate on these skid roads was reduced 92 per cent of that in the uncut area, and subsequent establishment of seedlings was reduced by two-thirds. In other words, the compacted and puddled condition of skid roads induces surface runoff, and the surface scar does not heal quickly. Another study (5) in eastern Washington and eastern Oregon, showed that tractor logging denuded 21 per cent of the area, and that deep soil disturbance (in which mineral soil was displaced in depth from an inch to several feet) occurred on 15 per cent of the area.

The gradient of skid roads affects surface runoff and erosion. On a tractor logging operation in New York State, the skid roads were oriented up and down a steep hillside on an erodible soil. Within a few months, one skid road had been eroded to bedrock, and this new landscape feature instituted a permanent change in the hydrologic regime of the area. Within a year after logging in the steep mountains of West Virginia (11), 0.4 inch of soil eroded from short skid roads with a grade of 0-20 per cent, and the amount of erosion increased 75 per cent on skid roads with grades of 21-40 per cent. Deep soil disturbance is aggravated in steep terrain because fewer logging roads and landings are built, and consequently the skid roads are longer and are used more heavily. Thus, in the Pacific Northwest (5) disturbance on slopes 40 per cent or greater averaged 2.8 times more than on gentler slopes.

One of the keys to efficient tractor logging is a well-planned and well-executed network of skid roads. The problem of installing an acceptable system of skid roads in mountainous terrain was investigated in West Virginia (12). The investigator realized that water resources are impaired by faulty skid roads, especially those that run straight up and down hill, but his problem was an economic one: Can a mountain forest be logged economically if skid roads are located properly with due regard for the water resources? The study showed that in contrast to a haphazardly located skid road system, a well-planned one required a fourth of the mileage and a fourth of the cost of construction. Undoubtedly, damage to the water resources—whether in increased turbidity or in greater surface runoff—can be reduced to an acceptable minimum by planning and building well-located skid roads.

Proper location is not the only skid road problem that besets the logging engineer. Other plaguing problems require his attention and must be solved promptly: Can skid roads be drained efficiently during the logging operation and how can they be stabilized after the timber has been harvested? These are important questions, and they can be answered only by intensive research.

Figure 2. Logs today are hauled out of the woods over truck roads. Erosion has been severe on this logging road, abandoned without proper provision for drainage.

Comparison of Logging Methods

Of the various cable systems, ground skidding probably causes the greatest amount of soil disturbance. Yet, data are available to indicate that this system produces far less damage than that brought about by tractor skidding. Moreover, study in Oregon and Washington (5) showed that jammer logging (a variant of ground cable logging) is superior to tractor logging: jammer logging on an area considered too steep for safe tractor operation produced far less deep soil disturbance than tractor skidding on more favorable terrain—2 per cent of the area as compared to 15 per cent.

Loggers have at their disposal several alternatives for removing timber from the forest. Each logging "chance" presents a challenge that must be met in the most efficient fashion. Does a conflict exist between so-called efficient methods and those that consider the aftermath of the harvesting operations? Land managers know that the productivity of steep, unstable areas is frequently impaired by tractor logging. On the other hand, the Wyssen skyline crane, a cable system that was designed specifically for steep, mountainous terrain, could not and should not be used in level terrain.

Different logging methods are particularly adapted to different terrains, and the role of research is to determine the limiting points of these methods. Where should tractor logging be excluded? What areas are so unstable as to require the introduction of new logging systems? Should soil moisture conditions govern the time of logging? These questions and many others must be answered if forest lands are to maintain their hydrologic function.

Truck Roads

Trucks are indispensable to modern logging. This means that a network of roads must crisscross a forested area from which timber is to be harvested.

With modern earth-moving machinery, roads can be built anywhere, and the results can be—and frequently are—disastrous. A study (6) of a typical logging job in North Carolina showed that after a 1-inch storm, stream turbidity increased 48 fold. The average increase in stream turbidity over a 3-month summer period was 22 fold. This fantastic increase in stream turbidity was traced to a few localized trouble spots in the roads. In other words, damage to the water resulted not so much from logging itself, but from road construction.

Because roads can be built so easily with modern earth-moving equipment, the tendency among logging engineers is to build roads as they are needed, without any thought of an overall plan. The result is an excessive mileage of poorly located roads, thereby accentuating the opportunity for erosion and stream turbidity. Studies (7, 8) in steep Oregon topography revealed that roads and landings occupied 12 per cent of a logging area, but that a well-planned road system reduced the mileage by 11 per cent and decreased the percentage of steeper road gradients by 73 per cent. Moreover, good planning tripled the area located within optimum skidding distance.

To properly plan and locate a system of logging roads is only one of the road problems associated with modern timber harvesting. The Roman military engineers of ancient times were great road builders and went to great lengths to keep water off the roads. The modern logging engineer must still follow this precept, but the damaging consequences of a faulty drainage system are much greater. Even ridgetop roads are subject to severe erosion when improperly drained.

In planning a drainage system, the logging engineer must consider the drainage characteristics of the different soils encountered along his route. In addition, he must take great pains to stabilize the numerous cuts and fills made in every logging road. Research can show how drainage and erosion control can be achieved in the most efficient and economical way.

Slash Removal

The final step in the progression of timber harvesting involves the disposal of waste material. After logs have been removed from an area, large volumes of slash remain behind. The needs of forest management and fire hazard reduction dictate the removal of this slash. Fire is the tool most commonly used in many sections of the country.

Much has been written about the destructive floods and erosion associated with *uncontrolled* forest fires. As an example, an early report (2) submitted to the Governor of Utah stated: "The small fire in the brush may

represent little drama, but when the brush goes, very often the soil goes, too; and with the soil the water; and with the onrushing water the security of the people is endangered." On the other hand, the use of *controlled* fire as a tool for the removal of logging debris may present a different picture.

Early research (1) indicated that fire significantly decreased the rate of infiltration. But recent research has shown that controlled burning in forests should not be completely condemned. Hydrologic effects of severe and light burns may be distinctly different, according to Tarrant, who found that severe burns reduced percolation rates by over 70 per cent whereas light burns increased those rates (10). Moreover, in the clear-cut areas examined, less than 5 per cent of the burned areas were classified as severely burned. Another study (4) reported only 8 per cent of a slash-burned area as being severely burned. Of course, it is possible that the effect of these small patches of severely burned areas may extend far beyond their insignificant areal extent. Catastrophic floods in Davis County, Utah, were traced to severe fires and overgrazing on only 2 to 10 per cent of the headwaters area (3). It is conceivable that in certain critical forested areas the effects of severe patch burning may be analogous.

Severe burning can be reduced or eliminated perhaps by a better distribution of the slash, by properly timing the period of burn, by economical chipping of slash, or (preferably) by a better utilization of the timber crop.

Figure 3. Controlled burning is commonly used to dispose of slash that accumulates as a result of logging. Additional research is needed to fully assess the hydrologic significance of such burns.

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Political and Economic Framework of Water Resource Research

(Continued from page 157)

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[2] Cf. John R. Commons, *The Economics of Collective Action*, The Macmillan Company, 1950, Chapter III.

[3] It is, of course, recognized that market resource allocation takes place within a legal framework and that legislature allocation is usually influenced by market considerations. The point here is to call attention to these two basic resource allocating processes in order to suggest that economic or political theory developed from study of one process may be ill adapted for solving problems occurring primarily within the other process. For another point of view concerning this subject, see Erich W. Zimmermann, *World Resources and Industries*, revised edition, Harper Brothers, 1951, pp. 21-30. Zimmerman divides our economy into three categories, the private sector, the public sector, and the "third economy" in which private and public interests are both involved.

[4] The concept of the "public" used here was developed by John Dewey. See *Intelligence in the Modern World*, Random House, Inc., 1939, pp. 365-370.

[5] Cf. Kenneth J. Arrow, *Social Choice and Individual Values*, John Wiley & Sons, 1951, Chapter 1.

[6] F.S.C. Northrop makes a similar classification which he terms "Normative Social Theory" and "Factual Social Theory." See *The Logic of the Sciences and the Humanities*. Macmillan, 1957, Chapter XXI, pp. 328.

Introduction of New Plant Materials In the Cornbelt States

KENNETH WELTON

Thousands of new plant materials have been tested and evaluated in the Cornbelt states to facilitate soil and water conservation programs. Many of these plants are now serving a useful purpose on farms and ranches. The search for new plants to provide for a particular conservation need continues. It is a never ending process.

This article by Kenneth Welton is the first in a series of two papers. It generally covers what has been done and how the work is organized in the new plant materials centers. The second part will appear in the September issue of the JOURNAL.

FROM THE VERY BEGINNING of the soil conservation movement, one of the most harrassing problems that faced the farmer who wanted to rearrange his fields for conservation farming was that of fencing. It would cost a lot of money and work to tear out old straight fences and replace them, sometimes on the contour, between two different kinds of land that required different treatment.

Then, in 1937, a plant common to rose growers as a hardy rootstalk on which to bud ornamental roses, was set out in a row in the Soil Conservation Service nursery at Elsberry, Missouri. In a short time it grew to a height of six feet, so thick that even pigs could not get through it. Thus, multiflora rose demonstrated its value as a living fence and today hundreds of miles of this living fence adorn the land of soil conservation farmers, harboring countless song birds and small animals (15), (16).

The Elsberry nursery also pioneered the Amur honeysuckle in the early 1940's. This late fruiting shrub holds its berries until almost Christmas and has proved to be a popular screening ornamental with wide use for wildlife habitat improvement.

These are but two of the many new plants promoted or even discovered by Soil Conservation Service nurseries that have been adapted to farms far and wide to serve the cause of soil and water conservation. A lot of testing was done with various shrub lespedezas—some of which are used widely, including Sericea lespedeza, for border plantings around farm woodlands for quail and other game bird food and cover in the Cornbelt States.

Kenneth Welton is field plant materials technician. He represents the Washington office of the Soil Conservation Service in the Cornbelt states and is headquartered in East Lansing, Michigan.

Plant Materials Centers Evaluate New Plants

While the nurseries no longer function in a plant production program, their successor, the plant materials centers, are more than ever the source of new plants being utilized in soil conservation district programs. Hundreds of plants are assembled at the centers and evaluated for various purposes. Selections are then finally tested under local conditions as field plantings on cooperating farms. The emphasis at these centers is on plant introduction, observation, evaluation, seed increase and proper management.

In the Cornbelt, work at plant material centers at Elsberry, Missouri, and near East Lansing, Michigan, is coordinated with the most comprehensive, cooperative program of evaluating plants by field planting ever undertaken in these states. Over 2,500 district cooperators in more than 750 soil conservation districts in nine states have made field plantings of new plants on their farms in the last six years in an attempt to solve their problems in cooperation and with the technical guidance and help of Soil Conservation Service technicians.

This in no way minimizes the work done under the old nursery program. The millions of plants grown in the early nurseries were planted by farmers cooperating with CCC camps or soil conservation districts. The trees supplied by the Soil Conservation Service nurseries were

Figure 1. One of the early multiflora rose fences planted on the Soil Conservation Service nursery at Elsberry, Missouri, in 1944, now plant materials center. It is still healthy and there has been no spreading.

Figure 2. Two year old plots of smooth bromegrass planted in 1939 on the Soil Conservation Service nursery, Elsberry, Missouri, now plant materials center. Plot on left is from Kansas-grown brome; plot on right is from northern-grown (Canadian) and is 90 per cent weeds.

matched with trees purchased from state and commercial nurseries. These plantings were used to stop erosion on denuded slopes, to improve the soil, grow timber, Christmas trees, produce fence posts, windbreaks, and improve wildlife habitats. The Elsberry nursery alone produced up to 16 million plants each season, made up of about equal numbers of trees and shrubs.

Along with tree and other woody material plantings, the Soil Conservation Service cooperated with agricultural experiment stations, soil conservation districts, and other agencies in testing many grasses and legumes for special erosion control and land use improvement purposes. This led to the discovery of a number of plants with superior qualities that are now in common use throughout the Cornbelt and beyond.

Probably the leading contribution of the Soil Conservation Service nursery program was in bringing about the much needed shift in the Cornbelt States from Northern-type smooth bromegrass produced largely in the Dakotas and Canada, to the Southern type. The Ames nursery took an early lead in working with the Iowa Agricultural Experiment Station (3). The Fischer strain was originated at the Soil Conservation Service nursery at Ames (18), while the Elsberry nursery originated the Elsberry strain and went into production of the better strains in 1940.

The widespread Soil Conservation Service field planting of these *Southern-type bromes* made in cooperation with the soil conservation districts soon convinced cooperators of their superior forage production and soil-building qualities (12), and brought about the general adoption of this grass as a companion crop to alfalfa in meadows, as pasture, and as just plain ground cover, instead of timothy and northern brome then in general use. The value of this work to Cornbelt agriculture probably exceeds the cost of all the plant materials work done to date in the Service.

Districts Cooperate With Plant Materials Centers

The Paducah, Kentucky, nursery was particularly prominent in testing and introducing tall fescue. The Kentucky 31 strain, sponsored by the Kentucky Agricultural Experiment Station, was found to be equal to the Alta strain from Oregon. Both strains are valuable in soil conservation work for pasture under soil and temperature extremes and as a ground cover for soil protection on fills, cuts, and waterways. The nurseries got quick acceptance in soil conservation districts throughout the Cornbelt by seed distribution and field plantings (2).

At this time the Paducah nursery was also active in the evaluation and distribution of Sericea lespedeza as a perennial legume for hay and pasture on low fertility soils and as field border plantings for wildlife food and and shelter (14). In 1948 this nursery produced more than 30,000 lbs. of seed of an improved strain, not then available on the market, for distribution to Cornbelt soil conservation districts.

More than fifty woody plants (not including almost thirty hybrid poplars) were tested between 1938 and 1951 at the Soil Conservation Service nursery at Winona, Minnesota, for hardiness, disease resistance, and other qualities needed in the field work. Purple willow varieties and Robusta hybrid poplar for windbreak and shelterbelt purposes were brought into common use through this nursery.

When the Soil Conservation Service started work in Michigan in 1935, it was immediately faced with the problem of controlling sand dune movement and the formation of sand-blow areas. The Board of Supervisors of Ottawa County was alarmed with the costly damage to property adjoining the shifting sand, particularly to highways, and had started a small nursery in 1932 to provide planting materials for control work. The Soil Conservation Service took the leadership in finding a solution to this problem, particularly by investigating

the placement and spacing of mechanical and living barriers, in perfecting methods of planting and in the maintenance of suitable plants under these extreme conditions. It was found that either the European or American species of beachgrass could be used satisfactorily to stabilize the shifting sand, and that when this was done the affected areas could be reforested with various species of pine (9).

Reed canarygrass for gully control was largely pioneered by the Ames, Iowa, nursery (6), but seed was often of low germination. It was difficult to plant and too often was washed from the areas planted. The Soil Conservation Service assisted many districts in the establishment of sod banks from which sod could be dug for the use of the cooperators. In recent years Soil Conservation Service personnel in Iowa have perfected the "green-hay" method, which requires less labor. Only the freshly cut aerial growth is used.

Many species and strains of native grasses were evaluated by the nurseries in the early days of the Soil Conservation Service (8). Blackwell switchgrass from Oklahoma was found adaptable over the entire Cornbelt for spring seeding of waterways on infertile sites, both on dry sand and wet soils, and for cover and wildlife food patches on badly eroded areas. Sand lovegrass as well as switchgrass was found to be useful in blow-sand control and when combined with annual lespedeza provides cover where cool-season grasses, such as bluegrass and orchard, would not persist. Canada wild-rye proved to be a good companion crop for native grasses such as switchgrass, Indiangrass, and big and little bluestem (5).

Of the legumes, the most important contribution from the old nursery program in the Cornbelt was the promotion of birdsfoot trefoil for permanent pasture renovation on land not suitable for cultivation (7). Field plantings in the early 1940's established the value of "Empire" birdsfoot, a domestic strain from New York State.

Plant Materials Are Collected From Many Sources

With the discontinuance of the production nurseries, the valuable data collected in the past are the basis of much of our present day work. The solution to many problems in soil conservation districts is still through the introduction of some new plant material. *The term "new material" is being interpreted in the Cornbelt plant materials work as any plant that is not known or in general use in the location where it is being evaluated.* Plant materials workers do the practical and obvious by first evaluating materials of proven value elsewhere. When such materials prove satisfactory, they are often immediately available to local districts because seed or plant sources have been established. Knowledge of the literature, reports, and contacts with technicians and centers in other groups of states often gives the leads needed.

In the plant materials work of the Soil Conservation Service, new materials are collected from many sources, including Service plant materials centers in other groups of states, plant introduction stations of the Agricultural Research Service, agricultural experiment stations, commercial sources, and by selection in the field. Plant breeding and testing work done by the agricultural experiment stations are followed by the Soil Conservation Service in case some plant meeting our particular needs is brought to light. Often the station workers know of new species, varieties, and strains with characteristics

Figure 3. Beachgrass planted in pattern on sand dune at Grand Haven, Michigan. The centers of squares are now ready for planting with conifers. This method proved most satisfactory both as to results and cost.

Figure 4. A corner of the observational plot area at the Elsberry Plant Materials Center where visiting plant materials technicians and agronomists are studying grass accessions.

in which they are not particularly interested; or, if the interest is there, the use is not being developed to the point where it can be used in district programs.

The Soil Conservation Service, working with farmers over a broad range of land capability, finds numerous problems, many of which are not connected with immediate cash returns (17). Our lines of communications with possible sources of needed materials and our technique of evaluating materials and getting chosen ones into commercial channels have been, and are, continuing to be an important contribution to the coordinated soil and water conservation program.

To gain a broader climatic base for testing, a new plant materials center near East Lansing, Michigan, was approved in 1956. With this new center, we have a fairly good spread of conditions for testing plants for Cornbelt conditions. Plants from the humid south and the comparatively dry plains may be introduced at the Elsberry Center for possible use in the southern Cornbelt, and from the northern plains and Appalachian region in Michigan for Great Lakes and northern Cornbelt use.

Tested materials that appear suitable for solving problems throughout this large group of states[1] are increased sufficiently for more extensive testing and finally evaluated under field conditions on the farm of soil conservation district cooperators.

Cooperative Programs Are Effective

The ultimate value of the plant materials work of today depends upon getting the new and proven plant materials into use in a relatively short time. The nature of the Soil Conservation Service field organization makes this possible with a relatively small number of specialists. State conservationists in Cornbelt states have agreed that work unit personnel would assist with plant materials work by making necessary contacts with district supervisors and county agents, selection of cooperators, selecting sites for plantings, working with the farmer in getting the plantings done according to plan, and finally in reporting results.

Only problems where work unit conservationists, district supervisors, and district cooperators have a real and pressing interest in solving are worked with. Seldom is more than one planting made in a district in a year. The work is divided among the interested and comparatively little of the work unit conservationist's time is required. Plantings made through work unit conservationist and district cooperator action, and evaluated under field conditions as part of the farming operation are much more readily accepted for general application than if the plant materials technician had tried to carry out the various steps himself. A great many more plantings are secured this way, more data are made available, and more people know the results.

Each planting is tied into the farm operations. For example, an entire field unit would be selected for a pasture improvement planting. It might vary from five to 20 acres or more. The Soil Conservation Service supplies enough of the seed of the introduced plant to seed half the acreage. The farmer supplies commonly used seed to plant the balance. He also supplies fertilizer and does the planting. The half seeded with the farmer's seed serves as the check against the new variety being evaluated. The introduced plant does not always prove better than the one he is now using, but it is rarely worse because it has already been tested at the centers, and we have a pretty good idea of its relative value before the field plantings take place.

Where field evaluations prove the new species to be acceptable and in demand, there may be a problem of assuring the farmers of a dependable supply. If commercial sources do not respond quickly enough, an agreement is drawn up with the soil conservation district, and growers are selected to increase the scarce item from seed or stock supplied from the plant materials centers. The use of both southern type bromegrass and birdsfoot trefoil as well as other plants useful in the soil conservation program was accelerated from an extensive seed increase program by soil conservation districts in Iowa (11).

Results Are Impressive and Effective

During the past six years, more than 2,500 plant materials field plantings have been made in the Cornbelt States. The loss has been about 20 per cent; so approxi-

[1]Cornbelt States—Ohio, Indiana, Kentucky, Missouri, Illinois, Iowa, Michigan, Wisconsin, and Minnesota.

Figure 5. An area training session in Indiana on the evaluation of a birdsfoot trefoil field planting.

mately 2,000 remain active, which means they are still being maintained and evaluation reports are being submitted when requested.

Results are kept on most plantings for five years. Actually, 20 per cent is not a real loss, as some plantings have served their purpose and have been discontinued. The losses from human causes were higher the first few years. But, with the continued training of Soil Conservation Service personnel, improvement in the selection of district cooperators and choice of more suitable sites, loss from this cause is now minor. Replantings following flood and drouth are to be expected.

Field problems are referred to plant materials technicians through technical and administrative channels, or frequently the plant materials technician discovers a problem needing attention. When a decision for plant materials work is made at the state programming level, the problem is written up as a project and approved by the state conservationist. Project outlines describe the work and authorize the extent and general location of field plantings and also the amount of cooperation between plant materials technicians and work unit personnel and with other agencies.

All pertinent data, such as site, soils capability class, past management, fertilizers, seed bed preparation, species planted, method of planting, and maintenance, are reported on an establishment report. Since large numbers of plantings must be evaluated at the same time of the year for information, work unit conservationists assist by making annual evaluation reports. Uniformity and quality of reporting is obtained through group training meetings and individual contacts.

Quite commonly the same problem exists over a wide area in a state or even over several states so that results may be summarized from many plantings. This final local evaluation at the site of the problem on the basis of comparison to check species provides practical answers.

The range of management encountered is one of the strong points of the system. It is progress when reports show that a significant majority of farmers, assisted by work unit conservationists, judge a new plant as superior to the plant or plants in common use.

If the new plant is satisfactory under conditions which may be described, then the project is completed insofar that its objectives have been met. The data gained are cleared with the cooperating agencies such as the state agricultural experiment station and the soil conservation district governing bodies concerned. Then the various established technical and informational procedures are followed in putting the new plant into general use.

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The Country Beautiful

FIRMAN E. BEAR

America, primeval, undisturbed, in the days of the Indians, was a beautiful place. But much of the virgin forest and soil gave way to the settler with his axe and plow.

Even so a new beauty has come—in the form of millions of acres of well-managed, productive, colorful domestic crops of fruits, vegetables, cereals and grass. A necessary beauty, to care for the needs of 180 million people.

Along with this though has also come unnecessary ugliness, waste and destruction, in plundered, naked, eroding soil scarred with countless gullies. There is an unfortunate correlation here. Ugliness in natural environment tends to produce ugliness in human behavior and outlook. Slums both in city and country, breed crime, immorality and ignorance.

THIS GOES ON, today, unchecked. We are still in a libertine stage of attitude to our natural resources. If a man wants to plow up a hill—that is his license, as far as present laws are concerned, over all but a few isolated situations in this country. If a man wishes to cover the finest agricultural land in the nation with pavements, houses, factories, roads or what have you—let his own poor judgment guide him. We're still lacking in legal code and even in politic conscience, as regards an obligation to posterity in this respect.

Interesting experiments have gone on and are still developing to close this abyss. The small watershed approach has been effective in joining local people's interests toward a better view of their conservation obligations to the community. On a larger scale, there has been the Tennessee Valley Authority with its 29 dams for water control and power generation. Similarly Texas has the Brazos River Authority with a program of dams and a chain of lakes 250 miles long. Ohio has its unique Muskingum Conservancy District, a far-flung land and water improvement program stimulated by floods in recent times; plus a similar project in the Miami Valley, again spurred by devastating floods that occurred just before the first world war.

New Jersey has its Stony Brook project, near Princeton, an excellent example of what a local community can do for itself.

Conservation Starts With Man

A shining goal for all of these programs, aside from physical achievement, is to develop in young and old a high sense of responsibility toward the soil and other renewable resources.

Dr. Firman E. Bear is well known to JOURNAL *readers. He is a charter member of the Society and served as president during 1950, and is now serving as a council member and chairman of the Society's Development Fund Board. His address is Soil Science, Rutgers University, New Brunswick, New Jersey.*

● For conservation is a way of life. It starts with man himself. It begins anew each day as he takes his morning bath, shaves, and puts on a clean shirt. It induces him to keep his trousers pressed and his shoes shined. It requires that he make himself presentable, first to himself, then to his family and finally to his fellowmen. He aims to look and act his best. *This is conservation of self respect.*

● If he owns a home, the conservation-minded man keeps it painted and in good repair. He strives for an attractive lawn that is free of weeds. He helps his wife in landscaping the premises and he encourages her with her flowers. He tries to put the idea of the orderliness and neatness of Nature across to his children. No trash is permitted to accumulate about his property. Leaves and other plant refuse are made into compost or carted away. Paper and similar wastes are picked up regularly and disposed of. Everything is kept neat and clean about the premises. *This is conservation of home and family.*

● If he is a farmer, he sees that something is made to grow wherever a bare spot appears. He will not permit the development of gullies that grow ever larger on his farm. He endeavors to keep the water that flows through his land crystal clear as much of the time as possible. He grows his cultivated crops on the contour, carries off the surplus water in sodded runways, and sows cover crops to protect his land during the winter months. Rough land is seeded down to grass or planted to trees. *This is conservation of soil.*

● Such a man takes the necessary measures to insure that as much as possible of the water that falls as rain soaks into the soil where it fell. To this end, he leaves the crop refuse on top of the land wherever feasible instead of plowing it under. He constructs a pond to store water for emergencies and to provide a recreation center for his family and friends. He participates in the activi-

ties of his soil conservation district in the building of up-stream dams for flood prevention and as a means of lessening the need for down-stream flood control. *This is conservation of water.*

● He enjoys the wooded areas, the rugged terrain on which they exist, the tall trees that tower above the surrounding cropland, and the clear streams that flow through them. He works toward their preservation and improvement. He plants more and better trees, and he protects them against damage by animals and fire. *This is conservation of forest lands.*

● He is interested in wild animals, birds and fish, and he takes an active part in the development of feeding grounds and sanctuaries to insure their presence in as great abundance and variety as local conditions permit. He encourages his children and those of his neighbors to study the habits of these creatures. And he does not abuse his hunting and fishing privileges. *This is conservation of wildlife.*

● If he is an industrialist, he insists that the property under his management be made to look as neat and attractive as the nature of his enterprise permits. If the property is situated within the city, he cleans up the grounds and paints the buildings. If it is located out in the open country, he beautifies the surroundings and develops an attractive recreation center for his employees and their families and builds good will among them and their community. *This is conservation of private enterprise.*

● If the processes in his factory are such as evolve dust and smoke, he takes measures to insure that these are reduced to a minimum and prevents the release of toxic fumes. He sees to it that all effluent from his factory is purified before the water is released into a stream. He plans the surroundings to insure sunshine and clean air for his employees. *This is conservation of purity of the atmosphere.*

● If he is an architect he seeks to do away with repulsive architecture, dilapidated buildings, automobile cemeteries, weeded areas, and slums, whether in city or country. He even cherishes the hope that the monstrous marble monuments in cemeteries will ultimately be replaced by small flat markers level with the surface of the soil. He wants these sacred grounds to be beautiful places where children can play and old people will not be depressed. *This is conservation of the human spirit.*

● If he is a highway engineer, he sees to it that all erodible cuts are protected with vines or shrubs or seeded down to grass. He thinks beyond the two winding strips of concrete that stretch from one great city to the next. He seeks for landscaped space, beautification of the right-of-way, and control of water runoff against possible damage to surrounding lands in times of heavy rains. *This is conservation of public property.*

● If he is a teacher, whether in the grades, the high school, the college, the university, the pulpit, or the theater, he bends his energies toward aiding child and man in their quest for knowledge and understanding. He endeavors first to know himself to the end that he can serve better in the uplift of those whom he teaches. *This is conservation of the mind.*

● If he is engaged in research, he seeks to discover more about the universe, the Earth on which he lives, and all the other entities with which man is directly or indirectly concerned. He seeks to know more about the life that surrounds him, including himself. But he also seeks to know about the physical and spiritual needs of man. He might even consider research in terms of suitable means by which population growth could be kept under better control. *This is conservation of man himself.*

Conservation Is a Way of Thinking

If soil conservation is this man's profession, his objective is "the promotion and advancement of the science and art of good land use and management to the end that conservation of soil and water and other related renewable natural resources—cultivated crops, livestock, grass, trees, fish, and wildlife—may be used and enjoyed by mankind forever." Such conservation is fundamental to the continued welfare of the Nation.

Whatever the business or profession of any man may be, there is always need to apply the principles of conservation to his field of endeavor. And there is abundant opportunity and great obligation for him to do something constructive.

Conservation is not only a way of life, it is a way of thinking. And if enough people can be brought to a conservation way of thinking, this can be made and kept the most attractive country on the face of the Earth.

Some of the natural attractiveness of the landscape will have to be sacrificed with further increase in population. But in its place usefulness with beauty can be added in new forms. The great expanses of corn, wheat and cotton can be grown to ever greater perfection. The greatly improved grasses and clovers can come to be an ever greater joy to the eye and mind The apple and peach orchards to the North and the orange and pecan groves to the South can be made more attractive and fruitful.

There can be many more beautiful public buildings, with spacious grounds. Parks can be enlarged and beautified. Private residences, and the yards and gardens surrounding them can be made more attractive. Finally, there are great possibilities for improvement in the people themselves arising out of a greater appreciation of our renewable natural resources, including man himself.

The Effect of HPAN Soil Conditioner on Runoff, Erosion and Soil Aggregation

HARRY E. WEAKLY

A SERIES OF FIVE PLOTS was established in 1952 on Sharpsburg silty clay loam with an 8.5 per cent slope and so arranged that rainfall runoff and erosion from them could be measured. Plots were 7x28 feet in size. One plot was left in the normal or untreated condition; three others were treated with 1,000 pounds, 2,000 pounds, and 4,000 pounds respectively, of the chemical soil conditioner HPAN, and a fifth plot was given a 5,000 pound per acre straw mulch.

The HPAN was applied but once during the study. The straw mulch was renewed every two years, the usual life of such mulch. Runoff was not measured in 1955 and 1956, so these years do not appear in the tables. No crops or weed growth were permitted on the plots except in 1955 when oats were grown.

An earlier report on this project was made in 1956 by F. L. Duley (2).

The treatments were applied on May 8, 1952 and the conditioner worked into the top three inches of soil by hoeing. During the first week no rain fell and the material was further mixed by additional hoeing, which also kept weeds down.

On May 15 and 16 a rain of 1.90 inches occurred which caused some runoff from all plots. At this time the HPAN formed a nearly continuous elastic mass with the soil and, as a result, runoff from the treated plots exceeded that from the check or the mulched plots.

After the soil had dried and been stirred again with a hoe, the untreated check plot lost more water from a rain which occurred May 21 than any plot except the one with the heaviest application of HPAN.

Runoff from all subsequent rains was less for the HPAN-treated plots than for the untreated check plot. Only once during 1952 was the loss from even the heaviest HPAN treated plot less than from the straw mulched plot.

Rainfall and Runoff Reflect Treatment

Table 1 gives a summary of rainfall and runoff for the period of record. It will be noted that for all years except 1958 the amount of seasonal runoff decreased progressively from the lowest rate to the highest rate of HPAN application. Straw mulch was very much more effective in controlling runoff losses than any of the rates of HPAN treatment. In all years except 1958 these plots were fallow. In 1958 a crop of oats was planted on all plots. Variations in stand were probably responsible for a large part of the departures of some of these plots from the average pattern for the period. The plot with the 4,000 pounds per acre rate of HPAN had only a half stand of oats due to rodent destruction of the sprouted seed. The plot which had received 1,000 pounds per acre of HPAN had about two-thirds of a stand as compared to the check plot. The straw mulched plot had a full stand of oats, but the crop was slow in developing and ripening as compared to the other plots. There was no noticeable variation in rate of development and date of ripening on the HPAN treated and check plots.

TABLE 1.
Record of rainfall and runoff from HPAN treated, straw mulched, and untreated plots (1952-1958)

Year	Total Annual Rainfall (Inches)	TREATMENT				
		None	HPAN—Lbs./Acre 1,000	2,000	4,000	Straw 5,000 lbs./acre
		Runoff in Inches				
1952	31.54	4.80	4.20	3.07	2.88	0.39
1953	18.38	1.39	1.21	0.61	0.20	.30
1954	30.57	9.02	7.11	6.26	4.89	1.04
1957	36.06	3.89	3.65	3.25	2.34	—
1958	35.61	4.83	4.72	4.27	5.01	1.62
TOTAL	152.16	24.00	20.89	17.46	15.32	3.35
Runoff—% of Total Rainfall		15.8	13.7	11.5	10.1	2.2
Relative Runoff		100.0	87.0	72.8	63.8	9.2
Runoff 1952-54, % of Total Rainfall		18.9	15.6	12.4	11.2	2.2
Runoff 1957-58, % of Total Rainfall		12.2	11.7	10.5	10.3	2.2

It may be noted that on the average the 1,000 pound per acre application of HPAN was very little better than the untreated check in that the percentage of the total rainfall lost through runoff was only 2.1 per cent less than the check plot. The amount of runoff on the other two rates of HPAN treatment was lower by 4.3 per cent and 5.7 per cent of the total for the 2,000 and 4,000 pound rates respectively, compared with the untreated plot. The amount of water lost from the straw mulched plot in the form of runoff was less than 3 per cent of the rainfall, as compared to almost 16 per cent on the untreated check. The per cent of the total runoff on this plot was only about one-eighth as great as that from the heaviest HPAN treatment.

Harry E. Weakly is soil scientist, Western Soil & Water Management Research Branch, Agricultural Research Service, USDA, Lincoln, Nebraska.

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There has been no great change in the relative percentage losses for the three HPAN treatments over the seven year period since they were applied. This would seem to indicate that the lighter applications have retained their relative effectiveness in reducing runoff about as well as the heavier applications.

Variations in Erosion Losses

Results of erosion determinations are given in Table 2. It may be noted that soil losses by water erosion decreased progressively as the amount of HPAN increased. In 1958 the variations noted in amounts of soil lost may again be attributed to differences in crop cover on the several plots.

For the entire period the soil eroded from the check plot was over 52 times that lost from the straw mulched plot; 4.4 times as much as the loss from the heaviest application of HPAN; 2.55 times that from the intermediate rate; and 1.89 times that from the lightest application. These differences demonstrate the general effectiveness of HPAN applied at several different rates as a means of reducing soil losses by water erosion. They also point out rather sharply the much greater efficiency of the residue mulch in achieving the same effect.

The 1,000 pounds per acre application of HPAN was not much superior to the untreated condition. Two thousand pounds of HPAN per acre almost doubled the amount of water required to remove one ton of soil; while the 4,000 pound application required 2.65 times as much water to remove one ton of soil. If the material had been worked into the soil to a greater depth, it is possible that the larger amount would have been relatively more effective. Work reported by Baird, Bonneman and Richards (1) would indicate that such may be the case.

It might seem logical that erosion would remove the conditioner rather quickly, especially in the case of the lighter application, but to date this does not appear to have occurred to any great extent. Undoubtedly some of the material is lost with the eroded soil, but erosion losses in this experiment were not sufficient to change the relative effectiveness of the various rates of application.

TABLE 2.
Seasonal and total erosional loss of soil from plots with three rates of HPAN application as compared to an untreated plot and a straw mulched plot

	TREATMENT				
		HPAN—Lbs./Acre			Straw 5,000
Year	None	1,000	2,000	4,000	lbs./acre
	Erosion—Tons per Acre				
1952	22.2	11.1	2.3	2.4	0.1
1953	7.4	5.6	1.9	0.5	0.5
1954	57.3	34.5	21.6	13.7	0.6
1957	9.2	9.9	7.6	1.6	0.0
1958	9.1	4.5	7.8	7.2	0.8
TOTAL	105.2	55.6	41.2	25.4	2.0
Relative Erosion	100.0	62.3	39.2	24.1	1.9
Tons of Soil Removed per inch of Runoff	4.38	2.66	2.36	1.66	0.59
Tons of Soil Removed per inch of Runoff (1952-1954)	5.71	4.09	2.60	1.85	0.69
Tons of Soil Removed per inch of Runoff (1957-1958)	2.10	1.72	2.05	1.20	0.49

Soil Aggregation Is Affected

The effect noted upon intake of water and upon soil losses by erosion would indicate that soil aggregation had been affected to some extent by the various rates of application of the soil conditioner. For this reason aggregate analyses were made on samples (0-3 and 3-6 inch depths) collected in the fall of 1954 at the end of three seasons, and in the fall of 1957 after six seasons for the 0-3 inch depth. These aggregate analyses were made by dry sieving with standard rotary sieves. Results of these aggregation studies are given in Table 3. It may be noted that for the 1,000 pound and 2,000 pound applications there was a very definite increase in the percentage of aggregates in the smaller classes, or those below 2.36 mm., by the end of the 1954 season. The increase in aggregation was also noticeable on the 4,000 pound rate, but the greatest increase in this treatment appeared in the 4.76 to 1.18 mm. sizes.

By the end of the 1957 season there were apparent further increases in the amount of aggregation. These increases were most noticeable in the class 4.76 mm. and larger for all rates of conditioner, as well as the check.

TABLE 3.
Percentage of aggregates of several sizes as affected by three different rates of application of a chemical soil conditioner and by a straw mulch

	Treatment														
	None			HPAN—1,000#/A.			HPAN—2,000#/A.			HPAN—4,000#/A.			Straw—5,000 lbs./A.		
Size of Aggregates (mm.)	1954	1957	Change 2nd 3 yrs.	1954	1957	Change 2nd 3 yrs.	1954	1957	Change 2nd 3 yrs.	1954	1957	Change 2nd 3 yrs.	1954	1957	Change 2nd 3 yrs.
	Per cent														
—4,760	0.05	15.04	+14.99	0.42	9.17	+ 8.75	4.43	20.68	+16.25	7.99	16.10	+ 8.11	0.00	70.51	+70.51
4.760—2.360	3.12	4.95	+ 1.83	5.14	4.80	— 0.34	20.63	5.84	—14.79	22.59	4.08	—18.51	1.35	5.33	+ 3.98
2.360—1.180	13.87	15.47	+ 1.60	12.66	14.97	+ 2.31	26.33	12.64	—13.69	38.02	10.95	—27.07	13.51	7.42	— 6.09
1.180— .590	20.07	31.65	+11.58	14.89	29.82	+14.93	12.91	27.83	+14.92	19.28	26.31	+ 7.03	27.02	9.35	—17.67
.590— .295	13.11	17.24	+ 4.13	9.39	18.02	+ 8.63	5.06	15.36	+10.30	4.68	17.77	+13.09	12.16	4.18	— 7.98
< — .295	49.79	15.57	—34.22	57.50	23.51	—33.99	30.62	17.61	—13.01	7.44	24.78	+17.34	45.94	3.22	—42.72

There were also notable increases in the two sizes between 1.18 and 0.29 mm. and less than 0.29 mm. on the 4,000 pound rate. During this second three year period, the straw covered plot showed an enormous increase in the two larger classes of aggregates with decreases for the smaller ones. The maximum size of aggregates on this plot was 37 mm. at this time.

During 1957 determinations of aggregation were made on the soil eroded from the plots by one intense rain. This material was all less than 2.36 mm. in size. On the straw covered plot the extremely small amount of soil lost consisted almost entirely of clay with some silt particles and showed no aggregation at all.

Summary

The chemical soil conditioner HPAN shows an effect upon water intake, soil erosion, and aggregation over a reasonably wide range of rates of application. This material is not, however, nearly so efficient at increasing intake or decreasing erosion losses as a 5,000 pound per acre straw mulch.

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Rural Zoning Fitted to Changing Needs and Conditions

WALTER A. ROWLANDS AND HARRY L. BECKER

RURAL ZONING has come of age. Three decades ago vigorous voices were raised against zoning. They said "zoning was an unwarranted invasion of property rights." Today those same voices defend zoning as an indispensable safeguard to individual rights. In areas where rural zoning has faced the test of time, farmers, resort owners and businessmen generally agree that the protection it gives is well worth the time and effort put into it. In fact, in more and more areas throughout the nation, planning and zoning are now recognized as a necessity to the better life. When people locally come to understand planning and zoning, they become strong boosters for it.

Wisconsin, Michigan, Iowa, Illinois, Ohio and California are among the thirty-eight states which have enacted basic laws authorizing rural zoning. The principles and purposes of land-use planning and rural zoning have steadily and surely won the support of both residents and local officials.

For many years conservation leaders throughout the nation have pointed out the relation between planning and zoning. They have shown the necessity of following approved procedures in the conservation of soil, water and other resources.

National and state farm organization leaders are increasingly mindful of the rapid invasion of both residential subdivisions and industrial development in rural sections of the country. These leaders have given planning and zoning their approval and their support.

Likewise, industrial leaders interested in new plant locations in rural areas want to know whether the community they are considering for a new plant site has an intelligent and farsighted approach both to residential and industrial zoning.

They want to know if the zoning laws are enforced so that plant sites and residential areas will be protected. They want to know whether the regulations under which they will live and operate their plant are reasonable or whether they will become an economic burden. They want to know if the zoning regulations are sound and whether or not they will be enforced rigidly and impartially.

An increasingly large number of rural residents both farm and nonfarm people now recognize that carefully conceived zoning ordinances backed by democratic land use planning have much to offer for the good of the community. Properly conceived zoning protects the property owners; gives stability to property values; promotes convenience; preserves the beauty of the countryside; promotes the conservation of natural resources; and provides a firm foundation for a more orderly development of land and water resources.

Rural Zoning Had a Humble Beginning

Planning and zoning did not happen overnight. Rural zoning was born of stern necessity. Out of the chaos of

Walter A. Rowlands is co-ordinator of Land Use Planning & Development, University of Wisconsin, College of Agriculture, Madison, Wisconsin, and Harvey L. Becker is county Extension Agent in Oneida County, with headquarters in Rhinelander, Wisconsin. Oneida County was the first county in northern Wisconsin to enact a rural zoning ordinance.

tax delinquency, abandoned farms and dead sawmill towns of the early 1920's, the Wisconsin Legislative Committee on Forestry and Public Lands proposed a new principle. This principle was that "both the orderly development of northern Wisconsin and the need for reducing expenditures because of tax delinquency require that counties be given authority to control development."

"Counties," the Committee said, "should have the right to give every possible aid in agricultural zones with the aim of building up prosperous farming communities. But they should also have the right in sections of isolated farms with heavy tax delinquency and numerous abandoned farms to set such areas aside as forest and recreation zones and be impowered to control the construction of more roads and schools."

From this vigorous presentation of the need for zoning, the Wisconsin Legislature in 1929 amended the strictly urban-type, county-zoning enabling act to broaden its purpose and permit the regulation of agriculture, forestry and recreation.

The first Wisconsin rural zoning ordinance, enacted in Oneida County in July 1933, had a simple clear-cut objective—that of separating and segregating forest and recreational land from potential farm land. This first zoning ordinance gained the support of town boards and local people because it brought about economy in local governmental services in roads, schools, snow plowing and other essential governmental services; gave protection to prospective settlers by preventing them from becoming stranded in isolated areas; and promoted more suitable development and use of the land in accord with its capabilities and local economy.

While great strides have been made throughout the nation in both land-use planning and resource development, we think the promise of planning and zoning for the future is even greater than all of the achievements of the past.

Northern Wisconsin, 1960

Let's look at northern Wisconsin as it is today. Since 1940 every census has shown fewer and fewer farms in all of its northern counties. This trend will undoubtedly continue. On the other hand, there are more resorts, more youth camps, more hunting and fishing cabins, more summer residences and more specialized water-oriented recreation. What is true in Wisconsin is equally true in Michigan and Minnesota.

There are also, in some areas of northern Wisconsin, more industries, more people and more business. New forest wealth is rapidly being developed under both public and private ownership and management. Moreover, these non-agricultural lands are producing a wealth of hunting and fishing opportunities. Space in which to practice these sports is now being given serious consideration.

The growth of residences, hotel and cottage type resorts, camps, marine-business establishments and public landings around Wisconsin lakes and along rivers has been phenomenal. So has the residential and commercial development within commuting distances from cities and villages. Likewise, there has been consolidation of school districts and a great reduction in the number of rural schools.

Changes In Population

Population changes since enactment of first zoning ordinance in Oneida County, 1933, show certain trends:

● *Towns with Recreational and Forest Resources*

	1930	*1950*	*% Increase*
Hazelhurst	193	231	+ 20.0
Minocqua	897	1431	+ 45.0
Three Lakes	941	1250	+ 33.0
Lake Tomahawk	274	418	+ 53.0
Woodruff	454	754	+ 66.0
	2849	4084	+ 43.0

● *Towns Within Commuting Distance of Industrial Centers*

	1930	*1950*	*% Increase*
Crescent	530	863	+ 63.0
Newbold	300	691	+ 130.0
Pelican	735	1928	+ 162.0
Pine Lake	435	1290	+ 173.0
	2000	4772	+ 139.0

Towns where the essential resources are chiefly forest or agricultural have declined in population. Towns within commuting distance of urban centers and towns with recreational resources (chiefly water) have increased in population.

New Growth Creates New Problems

The problems that have arisen from the unplanned development of the unrestricted use districts of the county zoning ordinances have created new and pressing problems for town and county government. Families who bought and developed homes on lake properties in expectation of continued enjoyment of peace, privacy and beauty vigorously protest the development of uses that will destroy or depreciate their property values.

More important perhaps but less clearly recognized by the property owner, will be the need to protect lakes, streams, wetlands and forests which originally attracted him to the region. This can be done by providing minimum lot-size areas, acceptable standards of sewage disposal to safeguard water supplies in the community, and protective, uncut borders of forest along streams and around lakes.

Auto salvage yards especially have blighted valuable lake frontage and residential areas. Unplanned development of commercial properties without adequate setbacks from highways have increased highway hazards and policing problems and have lowered property values and reduced local government revenues. Poorly-placed dumps are an eyesore and often destructive of irreplaceable natural beauty.

Figure 1. Forest and Recreation resources such as this will be of increasing importance in the future.

These are some of the "headaches" town and county boards are faced with and some of the problems that cause friction between neighbors especially in growing communities.

Citizens don't intentionally create these problems. In part they are the results of a lack of understanding by citizens in planning their own development—in part they are the result of a lack of community plans and a lack of understanding (perspective) of total land and water resource values.

The protection and preservation of private property values must be given major consideration in the enactment of new ordinances and the amendment of existing county zoning ordinances.

Zone the Flood Plains

People who build homes and business establishments in the flood plains of important rivers and other streams are bound sooner or later to be flooded out unless these establishments are protected by expensive levees or structures.

The American Red Cross has paid out some 60 million dollars in the past ten years in the United States to provide temporary emergency relief to families that have been made homeless and have sustained other tragic losses from damaging floods. This is in addition to aid given to these stricken families by the federal government, the states, and by city, county and town governments.

County planning committees, soil conservation district supervisors, watershed planning committees and other local officials, in our opinion, have a real responsibility to make careful studies of the flood areas of their counties and to plan for the protection of their citizens. The flood plains, the low-lying areas adjoining the streams and rivers that are subject to flooding during the high-water periods are an integral part of the river or stream, just as much as the main channel of the river. As such they should be so classified and used.

As the New York State Department of Conservation said so effectively many years ago, "It is better to keep people out of the path of the floods than to attempt to keep the floods out of the path of people." By the same token safe standards of land use for an area should be established before it becomes populated and expensive development work is undertaken.

A great deal of grief is sustained in "locking the barn after the horses are stolen." Almost every year throughout much of America we learn of hundreds of lives that have been lost through floods, thousands of families that have been made homeless and millions of dollars of property loss sustained by flash floods. ***This is an area that needs full consideration by planners and soil conservationists.*** That less than fifty communities in the entire United States now (1959) are receiving protection through flood plain zoning ordinances, is the learned estimate of Frances C. Murphy of the Department of Geography of the University of Chicago.[1]

There is nothing surprising about these catastrophic floods except the exact time of their occurrence. The Tennessee State Planning Commission pointed out that "twenty-four times in the past sixty years flood waters from Big Rock Creek have topped the banks in the vicinity of Lewisburg."

A recent watershed study initiated by the Red Clay Interagency Committee in Wisconsin recommended measures to improve the watershed of the Whittlesey Creek in Bayfield County, Wisconsin. Among the recommendations to improve the watershed was an emphatic proposal for flood-plain zoning. Such a program is being developed under the existing county zoning ordinance through establishing a new use district for the protection of people and private property. This new district contains regulations which provide that no human habitation may be built unless the main floor of the structure is at least seven feet above the high water mark of Chequamegon Bay, and likewise the outlet of all the septic tanks must be a specified number of feet above the high water mark of Chequamegon Bay.

If flood control provisions are established before much real development takes place, a great deal of loss to private property can be avoided and real protection given to all prospective land owners and new residents.

Likewise, zoning of this nature will have recreational benefits, for most river valleys of bottom-land timber and marsh type have potential wildlife value. Stream fishing is also given added safeguard by zoning restrictions.

Some real progress has already been made in the development of wetland wildlife and game areas in a number of Wisconsin counties, especially the Crex Meadows in Burnett County and the Powell Marsh in Iron and Vilas Counties. Work of a very similar character has been done by other states.

Significantly game managers working closely with soil conservation specialists, foresters, agricultural extension people and county forestry committees have drafted memorandums of understanding with many counties permitting the multiple use of zoned forest land for wildlife management. Many of Wisconsin's county forests now have active wildlife improvement programs in progress.

A great deal can be done in the planning and zoning of lands and waters best suited for forest game, prairie game, and wetlands game and fish. Some thought needs to be given and some experimental work undertaken looking toward establishing special-use districts under zoning for wetlands wildlife programs.

If we are to build up existing recreational resources and yes even to create new resources of interest and value to our recreationists we will need to consider the establishment in some areas of new artificial lakes and flowage areas and to provide a place for game, fish and wildlife native to the area. The importance of such water and wetland developments to migratory waterfowl must also be considered.

Some communities have already made a splendid start in this direction and much more can and should be done.

In such new land-use districts under zoning, the establishment of farms and legal settlement including year long residence would be excluded. Some county zoning committees are now considering such additions to their existing ordinances.

In Wisconsin, and in the other lake states especially, hunting, fishing and family-type recreation based on use of forests, streams and lakes is tremendously important in an economic sense. This economy can be protected and preserved through careful planning and zoning work in this new and fascinating field.

Recreational Districts to Fit Today's Needs

Recreational resources of all kinds need to be examined and studied by government and people, locally. Recreational resource development needs encouragement and wide citizen support.

Rcreational development in the Highland Lake District of northern Wisconsin involves one of the larger intensely developed lake and forest regions in the nation. Because of these facts the Oneida County Board has authorized its zoning committee to proceed with the revision of its original ordinance. Out of the many preliminary educational meetings with town boards has come a feeling that more use-districts are needed, that new regulations are required to protect health, safety and property values and that better methods of administration and enforcement should be devised.

Since the problems of individual towns often differ widely, the new ordinance must be "tailor made" to fit local conditions. The fuels that feed the fires of desire for improved zoning are many and varied. The extra-legal educational meetings conducted by extension agents, soil conservation people and district foresters, have helped both citizens and town and county officers in an understanding of the principles of planning and land use as they can be applied to their area. The meetings have brought into focus the fundamental problems to be considered, standards to use in their regulation and control and plans for the best future development of the community.

The planning and educational spadework required for

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[1] *For two excellent references on flood plains, see Murphy, F. C., Regulating Flood-Plain Development (1958) and White, Gilbert F., et al., Changes in Urban Occupance of Flood Plains in the United States (1958). (Both publications are issued by the University of Chicago, Department of Geography.)*

Figure 2. Good zoning protects and preserves these important resources.

understanding and approval of zoning within a town is as important as determining the content and text of the final county ordinance. Local people and local government should always have a definite part and place in the development of plans which affect them most. *This is the democratic approach in land-use planning and rural zoning.*

As a result of such procedure, local people have recommended the inclusion of seven new use-districts in the newly amended ordinance; a special lake-front business with adequate space and provision for public access and for "marinas" (the specialized commercial use-districts of the waterways); a recreational district; two types of residential districts; a combination residential and farming district; a commercial district; and an industrial district.

Furthermore, they have proposed regulations governing the development of minimum standards for building site areas, highway setbacks, side yards, and off-street parking. Again, they have proposed the inclusion of building and use permits to control and enforce the ordinance.

Because the beauty of the countryside is an asset of increasing importance to the recreation industry, local people are suggesting establishing standards of performance under which certain industries may operate in a way acceptable to the community in which they are located. Not all states in America have valuable national shrines and historic battlefields which alone attract a great many tourists and recreationists each year. But, clear water, green forests and interesting scenery coupled with fish and wildlife can be made the growth basis of an effective, profitable and permanent recreation industry.

Careful planning and zoning based on conservation principles now and in the future will not only protect and preserve these great resources but will aid in their further development.

Realistic Land-Use Planning and Zoning Can No Longer Be Delayed

It is time to re-examine, revise and re-design rural zoning ordinances better to fit the pressing needs of today and tomorrow. All signs point to increasing population pressure in the future. Planning for the future can best be done before the increase in population arrives.

Originally, northern Wisconsin zoning ordinances were accepted on the basis of promoting economy in local governmental services.

The future ordinances in northern Wisconsin like those in all other parts of the country must now be based on safe and sound plans for the best balanced growth of the community and the conservation of basic resources.

Above all, new ordinances to be effective must be simple, direct and easy to understand. They must emphasize positive, permissive and protective features of zoning. Both residents and landowners ought to have a definite part in the development of the ordinances and in any changes proposed in them. They have to live under the provisions of the ordinances and be governed by them. The original consent and continued support of people locally is most important.

Finally, any zoning plan must be flexible. When new legislation changes the methods and procedures, amendment of ordinances should be possible without too much delay—especially when new facts become available and when new growth and development demand amendments. After all, the purpose of the planning and zoning is to "provide for the welfare of people."

Let's Take Another Look At Summer Fallow in the Northern Plains

H. J. HAAS AND G. O. BOATWRIGHT

IS SUMMER FALLOW NECESSARY? This is a question that is receiving considerable attention in some of the northern states of the Great Plains. Research workers as well as farmers in the more favorable rainfall areas of the plains states are beginning to question the practice.

Increased yields brought about by summer fallow have in the past been attributed mainly to moisture conserved during the summer fallow period. Recent information, however, leads one to believe that increased available plant nutrients may be one of the major benefits of this practice. It has also been shown that certain crops can be substituted for summer fallow and that such cropping systems together with applications of sufficient fertilizer compare favorably with summer fallow for small grain production.

Erosion and Moisture Problems

Summer fallow is still a necessary evil in some sections of the Great Plains where moisture is more limiting, but wherever it is practiced, it is one of the principle sources of difficulty experienced with wind and water erosion. Stubble mulching has alleviated the erosion problem on fallow to a certain extent but it has not eliminated it entirely. In an alternate spring wheat and fallow system there is a period of over 20 months from the harvest of one crop to the seeding of the next crop. Adequate cover can generally be maintained until initial tillage in May or June of the year following harvest. Even where stubble mulching is practiced much of the residue has disappeared by the second fall and the surface is practically bare until seeding time the following spring. It is extremely difficult to control wind and water erosion when the land has little cover.

In addition to erosion problems associated with it, summer fallow is wasteful of the limited supply of water and plant nutrients. An example of summer fallow's inefficiency as a moisture conservation practice was shown by Thysell (3) working at Mandan, North Dakota. This study was conducted on fallow which was moldboard plowed June 1. He found that an average of 22.23 inches of precipitation was received during the entire fallow period, but that only 4.48 inches or about 20 per cent of the precipitation was stored in the soil. Similar results were obtained at other locations in the northern Great Plains and the prairie provinces of Canada. By subdividing the summer fallow period into three parts Thysell found that an average of 2.31 inches of moisture was stored in the soil between harvest time (late July or early August) and the following April, at Mandan, during which time 6.83 inches of precipitation was recorded. Between April and late July or early August only 1.43 inches of 8.62 inches of precipitation was stored, and only 0.79 of 6.78 inches was stored from late July or early August to seeding time the following April. When inches of water stored were expressed as a percentage of the precipitation for each period the values were 34, 16, and 11 per cent, respectively. These data show the inefficiency of fallow as a moisture-conserving practice and that it becomes less effective as the fallow period progresses.

In regard to summer fallow being wasteful of plant nutrients, studies of soils from eleven locations in the Great Plains (2) have shown that the loss of nitrogen from surface soils was greater under alternate small grains and fallow than under continuously cropped small grains at all locations except one. At eight locations, there was little difference in general between nitrogen losses from the soil in a fallow–small grain–small grain rotation and that of a corn–small grain–small grain rotation. Although the differences in nitrogen loss were usually small, they become more significant considering the fact that at most locations less total crop was removed from a cropping system which included fallow.

It appears that a partial solution to the problem would be to eliminate fallow where at all possible and use only those rotations or cropping systems which maintain a plant cover throughout most of the year. Since up to 80 per cent of the moisture received during the fallow season is lost, it seems that more efficient use could be made of this moisture by growing crops which would at least afford some cover and protection to the soil. Results from long-time crop rotations at three locations in Montana[1] and two locations in North Dakota (Table 1) indicate possible substitutes for summer fallow. Wheat yields following corn have been only approximately 1 to

Contribution from Soil and Water Conservation Research Division, Agricultural Research Service, U. S. Department of Agriculture.

The authors are soil scientists, Western Soil and Water Management Research Branch, Soil and Water Conservation Research Division, Agricultural Research Service, U. S. D. A., Mandan, North Dakota.

[1] *Data from Montana in Tables 1 and 2 furnished by the Montana Agricultural Experiment Station, Bozeman, Montana.*

TABLE 1
Average Wheat Grain Yields Following Fallow and Different Crops at Several Locations in the Northern Great Plains

Location	Wheat Following			
	Fallow	Corn	Oats	Wheat
	B./A.	B./A.	B./A.	B./A.
Havre, Montana	14.5	11.0	9.2	7.2
Moccasin, Montana	16.7	15.5	14.6	11.0
Huntley, Montana	17.6	13.3	10.4	9.9
Dickinson, North Dakota	20.9	19.5	13.6	11.6
Mandan, North Dakota	21.0	16.9	15.1	15.5

4 bushels per acre less than following fallow. Yields following oats were not much less than following corn at a few of the locations.

Although corn yields (Table 2) are not impressive by cornbelt standards, nevertheless the yields obtained would in most cases more than offset the loss in wheat yields where wheat follows corn instead of following summer fallow. In addition, if the ears alone were harvested, the stalks would afford some protection to the soil and would aid in holding snow during the winter. If the corn crop were harvested for silage it would be necessary to leave rows of standing corn at intervals to reduce wind erosion or cut the corn at sufficient height to afford some protection. Conlon and Douglas (1) of the Dickinson, North Dakota, Experiment Station have been advocating the use of corn as a substitute for summer fallow in small grain production for a number of years. It is realized that corn or other row crops are less effective than close-drilled crops in controlling erosion, but when planted on the contour, they are more effective than fallow. Figure 1 shows clearly the use of alternate strips of corn and wheat on the contour in the foreground.

TABLE 2
Average Corn Yields Following Small Grains at Several Locations in the Northern Great Plains

Location	Yields Per Acre	
	Grain	Total Dry Matter
	Bus.	Lbs.
Havre, Montana	11.0	2200
Moccasin, Montana	....	3370
Huntley, Montana	16.7	2280
Dickinson, North Dakota	17.9	3670
Mandan, North Dakota	26.4	3770

Figure 1. Alternate strips of corn and wheat on the contour aid in controlling erosion in Stark County, North Dakota.
Photo Courtesy of W. P. Sebens, Secretary, North Dakota State Soil Conservation Committee

Valuable in Years of High Production

It is generally believed that the value of summer fallow is greatest in years of low production. Average yields of a 35-year study from 3-year rotations at Mandan show that this is not true under conditions at that station (Table 3). One rotation consisted of fallow, wheat, oats; another rotation was corn, wheat, oats; and a third rotation was corn, oats, wheat. Each of the rotations was replicated three times. During these 35 years, there were 17 years when yields were less than 15 bushels where wheat followed oats, 10 years where wheat followed corn, and 9 years where wheat followed fallow. Although the frequency of low-producing years was much greater for wheat following oats, there was very little difference between wheat following corn and following fallow in this respect.

In bushels, the differences in yield following fallow and following corn or oats were greater in the high-producing years than in the low-producing years. In percentage, the reverse was true. The farmer is interested mainly in bushel differences.

TABLE 3
Comparison of Wheat Yields Following Oats, Corn, or Fallow During a 35-Year Period at Mandan, North Dakota[1]

Previous Crop	Number of Years < 15 Bus.	Av. Yield 18 High Years	Av. Yield 17 Low Years	Difference From Fallow				Mean Yields 35 Years
				High Years		Low Years		
	Years	Bu./A.	Bu./A.	Bu./A.	%	Bu./A.	%	Bu./A.
Oats	17	20.9	9.0	—7.2	—26	—5.2	—37	15.1
Corn	10	22.5	10.9	—5.6	—20	—3.3	—23	16.9
Fallow	9	28.1	14.2	....		....		21.3

[1] The 18 years when wheat yields following oats were greater than 15 bushels were considered the high-yielding years, and the 17 years when yields were less than 15 bushels were considered the low-producing years. Average precipitation during growing season in the 18 high-yielding years was 10.2 inches and in the 17 low-yielding years was 7.0 inches.

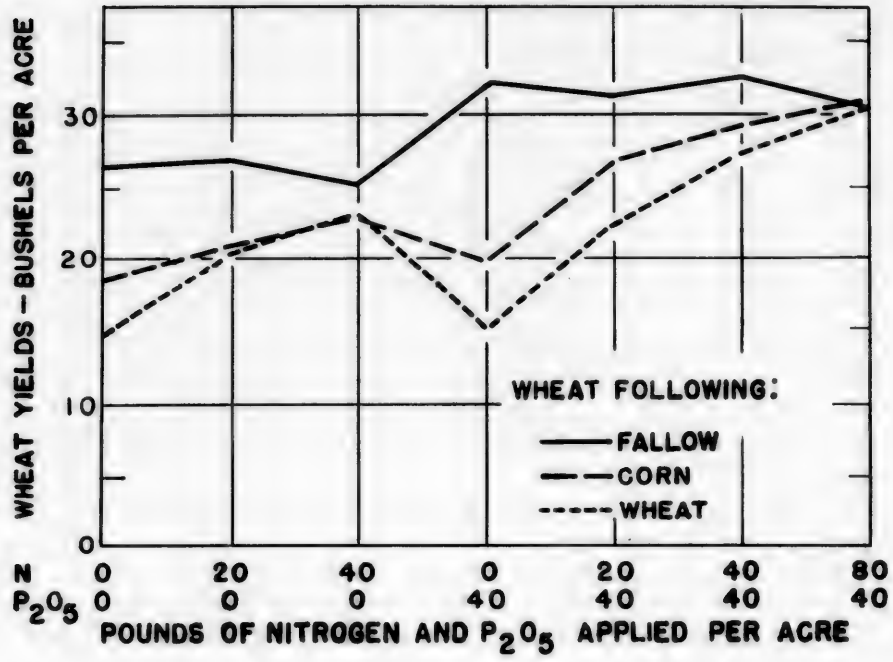

Figure 2. Yields of wheat from different fertilizer treatments following fallow, corn, and wheat, at Mandan, North Dakota.

These results show that a majority of the years have been high-producing years and would indicate that farming practices should be used which would take full advantage of these years. The greater benefit from fallow in the more favorable years is probably due in part to the greater quantity of available nitrogen released by this practice. The benefit of this additional available nitrogen should be greater in the more favorable years. If nitrogen fertilizer had been used the yield advantage of fallow may have been less.

Further study of these rotations has shown that the difference in wheat yields following fallow and following oats or corn became greater as the years of cropping increased. Although the loss of total nitrogen from the surface soil of the fallow rotation has been nearly as great as that from the rotations containing corn, years of cropping apparently have not influenced the available nitrogen content of the soil following fallow to as great extent as following corn or oats. These results would indicate that greater quantities of nitrogen fertilizer are required on corn or small grain land at the present time in order to produce wheat yields comparable to those following fallow than were required earlier in the cropping period.

Fertilizers Reduce Fallow's Yield Advantage

Recent work at Mandan, North Dakota, shows that fertilizers are effective in reducing the yield advantage of fallow. These studies were conducted on rotation plots which had been in operation for 40 years and which did not receive fertilizers during that period.

Beginning in 1955 and continuing through 1957, various combinations of nitrogen and phosphorus fertilizers were applied to each crop in the rotations. Annual precipitation in 1955 was 18.3 inches, 16.6 in 1956, and 15.4 in 1957, compared to a long time average of 16.0 inches. There was no apparent deficiency of moisture in 1955. The yields were influenced by a shortage of moisture in 1956 and 1957.

Wheat yields from seven of the fertilizer treatments following fallow, corn, and wheat are presented in Figure 2. Where wheat followed corn the land was disked, and where wheat followed wheat or fallow, initial tillage was with a moldboard plow. Yields of the check plots (0-0 treatment) were greatly affected by the preceding cropping treatment. Where wheat followed fallow, yields were 12 bushels per acre greater than following wheat, and 8 bushels per acre greater than following corn. As the rate of nitrogen alone increased, the range in wheat yields was reduced due to increased yields on cropped land and a slight reduction in yield on fallow. There was no benefit from phosphorus alone for wheat following wheat, and only slight increases were obtained where wheat followed corn. However, maximum yields were approached with phosphorus alone following fallow. As the rate of nitrogen was increased in combination with 40 lbs. of P_2O_5, yields on crop land increased still further. At the 20-40 pound N-P_2O_5 rate following corn and at the 40-40 pound N-P_2O_5 rate following wheat, yields were about the same as the unfertilized treatment on fallow. Yields on cropped land were further increased at the 80-40 N-P_2O_5 treatment but were reduced by that treatment on fallow compared to the 40-40 N-P_2O_5 treatment.

Maximum yields obtained on cropped land were only 2 to 3 bushels per acre less than the maximum yields obtained on fallow. Thus the differences in wheat yields due to previous cropping treatment were largely eliminated by application of adequate fertilizers.

Although these results may not be entirely applicable to other soil types nor to areas or years of extremely low rainfall, they do suggest that the benefits from summer fallow in some areas may be due more to the higher concentration of available nutrients and not so much to the increased moisture supply. By substituting other crops for fallow and by applying the proper rates of fertilizers when needed, summer fallow could possibly be eliminated.

Young (4) discussed the possibilities of eliminating summer fallow in North Dakota and concluded that "with modern techniques of weed control and use of adequate amounts of nitrogen fertilizer, summer fallow can almost be eliminated from cropping systems of Eastern North Dakota and the favored moisture sites in the rest of the State. This is especially true in the areas where row crops are profitable." He also concluded that "in seasons when soil is moist to a depth of 2 feet or more at seeding time and weeds are under control, there is little or no justification for fallowing in any part of North Dakota." It seems important to determine those areas where fallow can be eliminated so that the practice of summer fallowing would be confined only to those areas where it is absolutely necessary for increasing the supply of available soil moisture.

It is not implied that summer fallow should be eliminated immediately from the Great Plains region as a whole for no doubt fallow is still necessary in a large proportion of the Plains area. As better moisture-conservation practices are devised the acreage of summer fallow can be limited still further, and eventually the final goal should be to eliminate summer fallow entirely. In many areas of the Great Plains, sufficient water is received to produce a profitable crop if most of it could be conserved and made available to the succeeding crop. As was mentioned earlier only approximately one-third of the precipitation which falls from harvest time to April the following year is conserved in the soil. If methods can be found which would conserve two-thirds of the moisture which falls during this period, then as much moisture would be stored in the soil by the first spring after harvest as during the entire fallow period.

Perhaps a solution can be found to the moisture-conservation problem in the not too distant future. In the meantime let's take another look at fallow and make certain that the benefits obtained from this practice are due mainly to moisture and not solely to the increased supply of available nutrients. The latter can be supplied by fertilizer.

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"Land use is a basic part of all programs. The best answer to long term productivity on much of our land is a major change in land use. In many cases it would involve the retirement of whole parcels to grass. Most important on any land is the application of basic principles of soil management and crop production. The foremost requirement of a good soil conservation program is maximum use of vegetation in erosion control. The same principles that guarantee maximum crop production provide the maximum in erosion control and soil maintenance. Programs in western Canada are generally designed to provide the farmer with the scientific information that allows him to apply his art to the best use and optimum management of his soil resources."

—W. E. JOHNSON, Department of Agriculture, Regina, Saskatchewan, Canada

Gullies of New England River Valleys

ROBERT S. PALMER

An evaluation of the problems arising from accelerated erosion in the New England river valleys has been made. Special emphasis has been placed on the Connecticut River valley because of its economic importance to the region. Methods of controlling gullies have been discussed and the use of trees has been cautioned against for this purpose.

LAND EROSION PROCESSES, their rate of development, and the methods of controlling erosion present a universal problem. When erosion depredates river terrace soils at an accelerated rate, extensive gullies are usually formed. The need to provide an immediate, effective means of forestalling the growth of a gully, frequently takes precedence over a careful consideration of the factors which may be used to control it. In place of control measures derived from an objective study, methods are used which are a response to a too prompt, short term evaluation of the problem. The prolonged use of poor management practices, or the neglect of a gullied site may also result in such an extensive problem that control may not be economically instituted by the land owner. Thereafter, no attempt to inhibit further depreciation of the land may be introduced.

In June of 1957 two projects related to the study of gully formations were initiated by the Soil and Water Conservation Research Division of the Agricultural Research Service, in cooperation with the New Hampshire Agricultural Experiment Station. One project was established to investigate causal factors of gully development and another was started to evolve methods for controlling gully erosion within the New England river systems.

The river valleys of New England are intensively farmed. Their soils are tillable and productive, and nearby markets are a further inducement to intensive cultivation. This has led to the introduction of practices which sometimes appear to improve the farmers' well-being, but create problems resulting from accelerated land erosion.

The Connecticut River valley is of primary importance to the agricultural economy of a substantial part of New England. The most well-known product of the valley has been cigar tobacco. From the southern boundaries of New Hampshire and Vermont, south to Middlesex County, Connecticut, about 25,000 acres of farm land formerly produced over 30 million dollars' worth of leaf tobacco. Massachusetts and Connecticut farms also produce large quantities of potatoes and truck crops.

Robert S. Palmer is agricultural engineer, Soil and Water Conservation Research Division, Agricultural Research Service, USDA, and adjunct professor of Agricultural Engineering, University of New Hampshire, Durham, New Hampshire.

Figure 1. Gully erosion in the Connecticut River valley is destructive to valuable agricultural land. Note the poor vegetal cover above the gully under study near Claremont, New Hampshire.

The northern part of the valley is principally used by agriculture to feed and nourish high-production dairy herds.

With the exception of milk and tobacco, nearly all the intensively-farmed crops are consumed within the valley. Where urbanization has not boomed land values, tobacco growers have been changing to other crop specialties because of decreased demands for cigar tobacco. Crop specialization or intensive farming of clean-cultivated crops such as asparagus has in some instances denuded the land of cover and has subjected increased acreage to more severe forms of erosion.

Gully Damage Is Extensive

Of all the New England river systems, gully damage as shown in Figure 1 has been most extensive in the Connecticut River valley. During the spring and summer of 1957, gullied areas were visited near the main stream and tributaries of the southern and northern portions of the Connecticut River valley. Field trips were also made to problem areas of the St. John and Merrimac River basins. As a result of these ground surveys, experimental sites were established near the Connecticut River in New Hampshire.

The soils of the Connecticut River valley are of glacial origin. The glacial fill forms a fairly continuous blanket over the bedrock. The average depth of the drift has been estimated to be 37 feet, but the outwash sands and lake bottom clays and silts reach to over 100 feet in some places. Because of its high elevation, the northern portion of the valley was not flooded by rising seas, and these soils tend to be sandy loams rather than clay loams.

The terraces in the valley do not maintain a uniform pattern, and terrace scarps of from a few feet to a hundred or more in height can be observed. Where the scarps are steep and poor vegetative cover exists, active erosion can usually be found.

Gully development is only a small phase of the geologic evolution which occurs slowly compared to man's life span. The universe is constantly changing, and the environment of living organisms is generally slightly out of balance. Geomorphological processes tend to slowly level higher elevations and raise lower areas. When man alters his environment, the unbalanced factors resolve toward equilibrium with rapidness. Erosion is accelerated when forests are removed from hillsides, when drainageways are combined or diverted to new outlets of insufficient capacity and when vegetation becomes sparse on the land.

Land Management Helps to Prevent Gullies

An approach toward solving gully problems might be to re-create the environment of the past. However, the unbalanced forces have already modified this environment and its duplication is difficult, if not impossible to achieve.

Figure 2. Geologic erosion may be accelerated by loads imposed on soil by trees. Mass of roots is effective until soil moves out below. Trees will ultimately topple into this gully at Orford, New Hampshire.

Figure 3. Additional weight of trees may amplify erosion activity. Stable gully reactivated at Bath, New Hampshire.

On visits to numerous gully sites various methods were observed which farmers employed to control gully growth. Almost all farmers react to a new gully by making an attempt to fill it in. An observer often notes that the sidewalls of a gully are strewn with bed springs, old stoves, branches, fencing material, and debris of all kinds.

For a time the gully appears to be stabilizing. One cannot see the soil moving out from below the trash until the trash slides further toward the bed of the gully. Further additions of debris do not aid in the mechanical stabilization of the gully, and vegetation which could help to protect the soil surface from the weather elements is prevented from establishing itself.

Some farmers are using measures which were established with the assistance of technicians and engineers employed by the Soil Conservation Service. Earth moving can obliterate a scarified landform or shape it into a waterway which can be protected with sod and fast growing cover crops. Mechanical structures such as drop

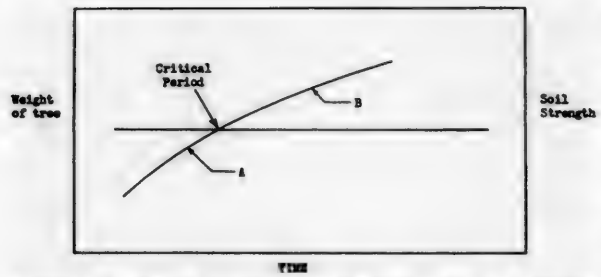

Figure 4. Idealized relationship indicating that soil strength remains relatively static as weight and height of tree increase soil stress with time.

inlets also have been effective in mollifying erosive forces.

Less expensive means of controlling gullies have also been tried by Soil Conservation Service technicians. In Grafton County, New Hampshire, chutes were tried unsuccessfullly. Dry wells constructed of two four-foot concrete tiles placed in low areas on an open field encompassed by a ridge along the terrace escarpment to induce ponding, appear to be effective after a three year trial.

Dense plantings of legumes and grasses, crown vetch, trefoil, switchgrass, and perennial rye grass above and within a gully have been effective when surrounded by a circuitous ridge above the gully head. Water normally directed toward the gully is diverted to less erosive locations along the terrace.

A ground survey of the terrace scarps of the Connecticut River in Sullivan County uncovered numerous small gullies with earth cuts of from two to five feet deep. They were located along the border of cultivated fields. In some areas the farmer had increased the border distance to the headwall, and activity appears to have ceased.

Soil and crop management can be an effective tool in preventing accelerated erosion. Farms located side by side on the same soil type, slope, and orientation are sometimes differentiated by the eroded landforms on the farm where vegetation is sparse through poor management, as compared to only nominal erosion on the neighboring farm where good crop cover is maintained.

Revegetation of a gully is an essential measure of control. It should be initiated as soon as the sidewalls have been stabilized and the area put into condition with the application of minerals to meet plant nutrient requirements. In selecting the type of planting to be made, it is important to anticipate future conditions which might aggravate the site and lead to reactivation of the gully.

Trees Endanger the Stability of Gullies

New England is a naturally forested area. Tree species adapted to this region grow rapidly and develop extensive root systems. Problems of excessive runoff and soil loss are often reduced by reforestation. Through the efforts of various conservation organizations, tree planting is encouraged on abandoned farm land and cut over woods. Where eroded areas preclude the use of the land for farming, a farmer may decide to put the land "back to trees." The eastern white pine, *Pinus Strobus L.*, common to the Podzolic regions, is often selected for seeding-in abandoned land. Its lateral roots have been found to extend as much as 70 feet and top growth to reach a height of 35 feet in about 25 years from time of planting.

Large trees have been observed to cause tension cracks near gullied areas which utimately tear away large pieces of soil and sod from the gully perimeter. Undercutting of the soil, as in Figure 2, has left extensive root systems waving above gully sidewalls. Observation also shows that most root systems near gullies are shallow and penetration into the B horizon is limited.

When the soil can no longer support the stresses induced by a tree's weight and the forces acting on the tree due to wind or eccentricity, failure will result, as shown in Figure 3. Perhaps this can be better illustrated by means of the idealized diagram in Figure 4.

The growth curve for a tree can be depicted as the dependent variable of weight or height. As the tree's size increases, additional forces are transmitted to the soil due to dead load and increased exposure of the tree to air movement. The soil strength is shown to be constant, although it would vary with the vagaries of climate and erosive action. The left-hand portion of the curve marked A denotes the period when root masses act to retard erosion processes. The critical period occurs when the forces imposed by the tree are just balanced by the soil strength. Portion B of the curve denotes the period of excessive loading, which is sometimes manifested by tension cracks above the gully and the ultimate toppling of the tree into the gully.

Trees can serve their most useful purpose in erosion control when planted on the area draining into gullies. When trees are found to be located near the gullies, they should be observed periodically and removed if they threaten to endanger soil stability.

Grasses which develop rhizomes or runners provide good ground cover and offer excellent protection for the sidewalls of gullies. In the northeast witch grass may be used to advantage for this purpose. Vegetation should be selected which will not create future problems.

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The Watershed Hydrology of Plow-Plant Corn

LLOYD L. HARROLD

THE MINIMUM TILLAGE or plow planting of corn has been reported by several research stations to have shown promising effects on yields. These encouraging results have made it desirable to evaluate this practice from the standpoint of its effects on watershed runoff and erosion. At a work planning conference several years ago, this study was incorporated in the existing watershed-research program at the Soil and Water Conservation Research Station near Coshocton, Ohio.

At the Station, single-crop watersheds are used to evaluate the effect of combinations of selected cropping and conservation practices. All watersheds are of 1 to 3 acres in size. A four-year rotation of corn, wheat, and two years of meadow has been studied for several cycles of the rotation under two levels of treatment, *prevailing*, and *improved*. The *plow-plant* method was added to this basic study in 1956.

The *prevailing* practice has consisted of straight-row tillage across the slope, a low level of fertilizer, liming to a pH of about 5.4, and an alsike-red clover-timothy mixture for the meadow. The *improved* practice includes contour tillage, a high level of fertilizing, liming to a pH of about 6.8, and a clover-alfalfa-timothy mixture for the meadow. The plow-plant practice is essentially the improved practice with plow-planting in the corn year of the rotation. In 1956 and 1958 the plow-plant method was mainly to plow on the contour, throwing the furrow slice uphill, and planting the same day with a two-row planter (Figure 1). The planter operated inside of the tractor wheel tracks and there was no extra compaction. In 1957 a single-row planter was mounted on a three-bottom plow so as to plant on the first furrow slice (after the New York development). The planting rate for 1957 was increased on the plow-plant watershed. Under the prevailing and improved practices of conventional tillage, the corn ground was prepared by plowing, disking twice, and harrowing once, followed by planting and by two or three cultivations to control weeds.

A different set of watersheds is in corn each year and because the soils and slopes of the watersheds vary somewhat these variations should be considered when evaluating the data. In 1956 all the corn watersheds were on well drained soil. Slopes of the prevailing and improved-

Lloyd L. Harrold is project supervisor, Soil and Water Conservation Research Center, Coshocton, Ohio. The station is operated by the Agricultural Research Service in cooperation with the Ohio Agricultural Experiment Station.

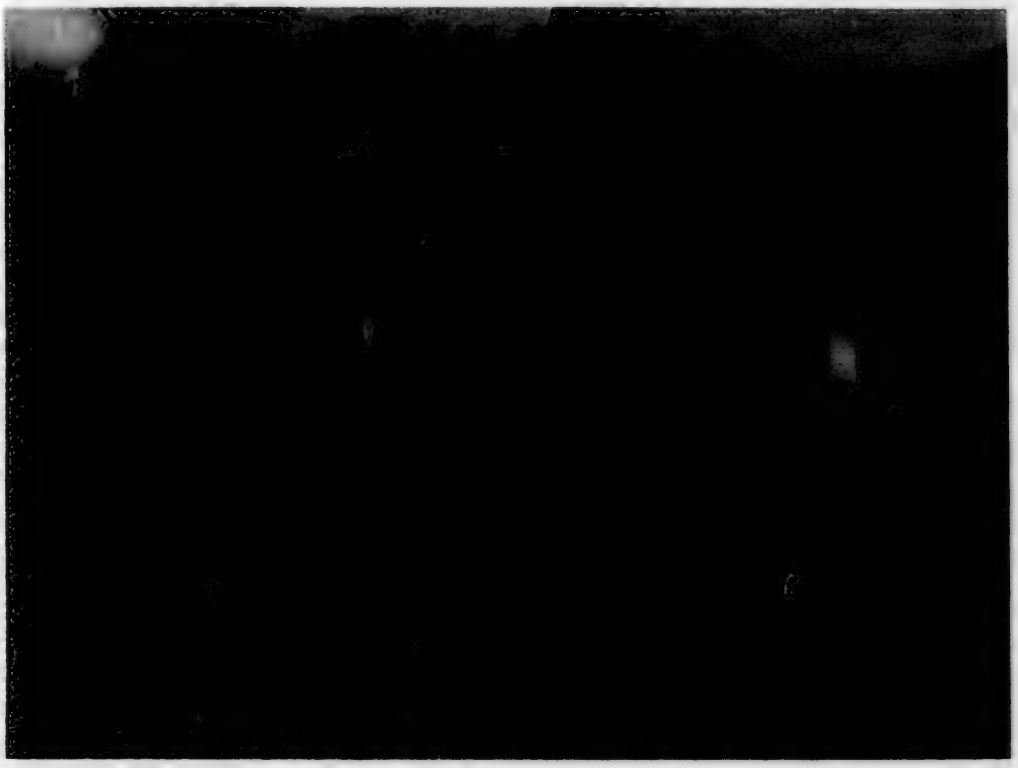

Figure 1. Planting corn on a plow-plant watershed.

practice watersheds both averaged about 15 per cent, whereas the slopes of the plow-plant watershed averaged slightly over 9 per cent.

In 1957, the corn watersheds were all on slowly permeable soil, with the plow-plant and improved-practice watersheds on the least permeable soils of the group. Land slopes of the prevailing and improved-practice watersheds were about 6 per cent and those of the plow-plant about 11 per cent. The plow-plant rows were from 0 to 6 per cent off contour.

In 1958, the watersheds of the prevailing and improved-practices were on slowly permeable soils and the plow-plant, on well drained soils. Slopes of the plow-plant watershed were over 13 per cent and of the prevailing and improved, about 12 per cent.

Runoff, erosion, and yield data for the three years of the experiment are given in the table. Hydrographs for a major storm runoff in 1956 appears in Figure 2.

The watersheds farmed with the plow-plant method during the corn years produced less total runoff during the growing seasons, except for 1957. Seepage flow on these watersheds prolonged the period of runoff.

Peak flows were least on the plow-plant corn watershed in each of the three years. Erosion losses were consistently less under the plow-plant culture.

When the stand of corn on the plow-plant watersheds was equal or less than on the prevailing or improved-practice watersheds, the yield was less. In 1957, the increased planting rate on the plow-plant watershed resulted in a heavy plant population. Corn yield on the plow-plant watershed was in this case greater than on the other watersheds.

The limited data available seem to indicate that the plow-plant method at the Coshocton Station will effect changes in the rainfall, runoff, and erosion relationships on small field size watersheds. The studies are being continued.

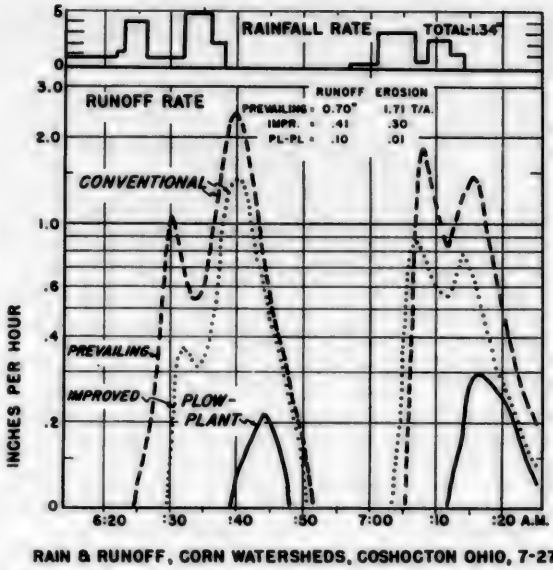

Figure 2. Hydrographs for a major storm runoff in 1956.

Runoff, Erosion, and Crop Yield on Corn Watersheds, May-September 1956, 1957, and 1958

Item	*Watershed Treatment*	*1956*	*1957*	*1958*
Runoff total	Prevailing	3.6 in	2.3[1]	0.9
	Improved	1.7	3.1[1]	1.0
	Plow-plant	.01	3.5	.2
Peak flow	Prevailing	2.5 in./hr.	4.1	1.5
	Improved	1.4	6.0[2]	.8
	Plow-plant	.2	3.1	.1
Erosion	Prevailing	7.1 T/A	7.1	0.4
	Improved	1.1	6.7	.2
	Plow-plant	.03	1.2	Trace
Yield	Prevailing	70 Bu/A	55	45
	Improved	105	109	118
	Plow-plant	82	124	101
Stand	Prevailing	10,000/A	11,400	10,500
	Improved	11,800	13,200	14,000
	Plow-plant	11,900	22,800	11,900

[1] Includes some seepage flow.
[2] Contour ridges failed in the June 12 storm having 3.2 inches of rain in one hour.

"It has long been established that soil and water conservation is a responsibility of government. It has also been established that state government is an important and essential segment of a democratic system of government. If state government is to fulfill its role, it is necessary that it assume certain responsibilities for services demanded by its citizens. This is just as true in the field of soil and water conservation as it is in education, health or the highway building program. State government can function only as long as it accepts certain responsibilities with the local and federal governments and this includes financial responsibility."

—WARREN D. FAIRCHILD, State Soil and Water Conservation Commission, Lincoln, Nebraska

Notes on Western Range Forbs: *Equisetaceae* through *Fumariaceae*. By WILLIAM A. DAYTON. U. S. D. A., Agriculture Handbook No. 161. 254 pp. illus. $1.75. 1960. (BEN OSBORN, *Washington, D. C.*)

Many range men and botanists will treasure this attractive little book as the final work of a widely known and respected figure in the field of plant taxonomy and range research. The manuscript left unfinished by Mr. Dayton's death was edited by his colleagues in the Forest Service and published as an Agriculture Handbook.

Following the phylogenetic order of plant classification, Mr. Dayton's notes treated about a third of the families of vascular plants with sufficient completeness for publication. The remainder of the job, unhappily, must await the attention of another worker with similar dedication and insight to compile the countless bits of information being accumulated in the Forest Service range plant herbarium.

The book is based on the voluminous notes accompanying the herbarium collections on Mr. Dayton's own observations and reading, and on the recorded experiences of Forest Service field men who gained familiarity with the plants in range administration.

For the species treated, the book gives a miscellaneous collection of descriptive information and notes on nomenclature, range, habitat, forage and food values, poisonous properties, and various oddments collected over the years.

Much of the information is available elsewhere, but not as here gathered in one place for each kind of plant. The bibliography of 216 references indicates the thoroughness with which the author had combed the literature. Many of the facts published for the first time will be already familiar to experienced range men of the West, but they will be pleased to see them set down in print.

The book may be regarded as a supplement to the familiar *Range Plant Handbook*, which also was largely Mr. Dayton's work. But this is primarily a plant collector's notebook, and will be relished by other plant collectors both for its fascinating array of information and for its reflection of the author's individual viewpoint.

Southern Forest Soils. *By* PAUL Y. BURNS *(Editor). 132 pp., illus., refs. Louisiana State Univ. Press, Baton Rouge 3, La. $4.00. (Reviewed by* S. A. WILDE, *Madison, Wisconsin.)*

Each year, beginning in 1952, the School of Forestry of the Louisiana State University has sponsored a symposium on the subject of forestry. In 1959 the theme of the meeting—*Southern Forest Soils*—brought together seventeen foremost specialists concerned with timber producing soils of southern states. Their contributions are incorporated in an attractive, cloth-bound volume, ably arranged and edited by Prof. Paul Y. Burns.

The paper, "Physiography and Properties of Southern Forest Soils," by S. A. Lytle delineates the major soil-forest provinces of the region, stressing the frequent deficiencies of soils in nutrients and water.

A possibility of augmenting the scope of information useful to forestry through the integration of knowledge from neighboring disciplines is suggested by R. E. McDermott and P. W. Fletcher in their report, "Physiological Relationships of Soils to Forest Growth."

Soil conditions influencing the infiltration, retention, and storage of soil water are discussed by L. J. Metz in his paper "Hydrological Properties of Southern Forest Soils." The author emphasizes the importance of conducting silvicultural operations in a manner precluding destruction of the humus layer and compaction of the soil surface.

Robert Zahner's report "Soil Moisture Utilization by Southern Forest Soil" discloses that uninterrupted transpiration, and hence the growth of trees, often requires reduction of stand density by partial cuttings.

"The Soil Conservation Approach to Soil-Woodland Interpretation" by Paul E. Lemmon outlines the correlation of soil types with different aspects of forest growth and forest management.

About one-third of the volume is taken up by reports on the forest site classification: "General Application of Site Evaluation to Pine Sites" by C. W. Ralston; "Forest Site Classification in the Southwest; an Evaluation" by Earl J. Hodgkins; "Soil-Site Studies of Southern Hardwoods" by M. B. Applequist; "Application of Site Evaluation to a Large Industrial Forest" by E. S. Thornton, and "Summary of Soil-Site Evaluation" by T. S. Coile. The soil-site studies with corresponding regression analyses are innovations introduced by Dr. Coile and Prof. Schumacher of Duke University. Contributions to this symposium show that ideas of these teachers are perpetuated by many of their former students. This is a gratifying experience for any originator of a new

approach, especially considering the profound statement of Theodore Roosevelt: *"The capacity of the human mind to resist the introduction of new knowledge is nothing short of marvelous. . . ."*

L. C. Walker, in his report "Fertilizing Southern Pines," enumerates many studies underway, with only few concrete results obtained from the application of fertilizers. An expression of successes in terms of percentage increases in height or diameter is not always enlightening; also a preoccupation of many southern foresters with only NPK fertilizers may bring disappointments.

J. F. Kraus and G. W. Bengtson delivered an interesting report on "The Use of Irrigation in Forestry," stressing the importance of artificial watering as a research implement. The validity of the authors' suggestion that "irrigation as a means of promoting forest growth is not likely to become a common practice in the South in our lifetimes" may depend on the age of the individual. Irrigation often doubles the diameter growth which spells quadrupled yield! Thirty years ago many foresters maintained that tree planting would not be a common practice in the USA in their lifetimes.

T. E. Maki's "Improving Site Quality by Wet-Land Drainage" reviews comprehensively the possibilities of increasing forest growth through an artificial control of the ground water level.

Valuable observations are presented by W. M. Broadfoot in his paper "Soil-Water Shortage and a Means of Alleviating Resulting Influences." Controlled flooding in the fall and subsequent drainage in April augments the supply of soil-stored water which benefits the growth of hardwoods during the critical summer period.

Carl E. Ostrom's paper, "Potentialities for Improving Forest Growth," provides the concluding chord, which is inspiring in spite of its slight disharmony with reality. The author rejects "classical," stereotyped silviculture, as well as "modern silviculture, which seeks adaptation of the forest to the environment. Instead he favors the "creative" silviculture, which aims through the use of fertilization, irrigation and cultivation to adapt the environment to the forest. An approach of this kind is particularly well suited to the environment of southern states, and it may bring fruitful, if not miraculous results.

According to the ideas of some tree improvement specialists, quoted by Dr. Ostrom, the present annual increment of 2½ cords per acre for pine plantations on the best sites of the South could be increased 85 per cent by cultivation, 60 per cent by fertilization and 30 per cent by genetic improvement to a total of 8.1 cords per acre per year. This would be so overwhelming an achievement that for the time being it may be well to keep the exact figure (with or without the decimal point) as a top secret, especially because a growth response to fertilization of plantations on the best sites has never been demonstrated. Moreover, the French saying, "extremes meet," suggests that a degree of conservation may help to preserve a safe distance between "creative" and "destructive" silvicultures.

Probleme De Pedologie. *Publishing House of the Academy of the Rumanian People's Republic, Bucharest, 564 pages, 1958. (Reviewed by* H. J. HARPER, *Stillwater, Oklahoma.)*

This book contains information on recent soil research in Rumania. Five papers in soil physics contained data on the effect of grass legume mixtures on water-stable aggregates, the effect of krilium on soil structure, the relation between hygroscopic coefficients and soil textures, and influence of soil type on soil permeability. Eight papers in soil chemistry presented data on the effect of vegetation and weathering on types of peat and their chemical characteristics; studies on adsorption; zinc, nickel and cobalt content of different soils; magnesium availability in soils; qualitative composition of humus in certain chernozems; brief reports on spectral analysis and mobile phosphorus in soils; and effect of storage interval on the solubility of soil elements. Two papers in soil biology discussed ammonification and nitrification processes in relation to pedological types, and the virulence of nodule bacteria of vetch and soybeans. Four papers on soil fertility topics discussed the influence of fertilizers on the production of corn, wheat and oats in a rotation; seasonal influence and fertilizer treatment on the solubility of plant nutrients; changes in the soluble nutrient supply and soil reaction under different crops; and aggregate stability and nutrient status of soil in an alfalfa-orchard grass meadow. Seven papers were presented on soil genesis, classification and cartography and included a discussion of taxonomic units and standards in soil classification; soils of the upper and middle Putna river basin; soils of the middle basin of the Bristrita Valley; soils of the flood plain of the Danube river; agricultural interpretation of soil maps; character and genesis of alkali soils on the left bank of the Crisul Alb river; and large scale mapping of forest soils. Papers on soil technology included soil erosion mapping; infiltration capacity of eroded and non-eroded soils; reclamation of saline rice soils; greenhouse and field studies on the improvement of solonetz soils; irrigation on the Rumanian Plain; and effect of soil moisture on the resistance of a brown forest soil and a chestnut chernozem to tillage.

Abstracts are given in Russian, English and German for each paper.

Water Resources Activities in the United States. Committee Prints of U. S. Senate Select Committee on National Water Resources, 86th Congress. 32 vol. Govt. Print. Off., Washington, D. C., 1959-1960.

Undoubtedly the most comprehensive report to date on the water resources and water problems of the United States is unfolding before us in the publication of the Committee Prints of the U. S Senate Select Committee on National Water Resources. Of the 32 volumes planned, 25 had been issued by July 1.

The committee was created to find out the nature and extent of the nation's water requirements now and in the future (1980 and 2000) and to inquire into how these needs could be met. Its membership includes the chairmen of the basic legislative committees of the Senate concerned with water affairs; i.e., Public Works, Interior and Insular Affairs, Agriculture and Forestry, and Interstate and Foreign Commerce. Senator Robert S. Kerr is the general chairman.

The committee has called on a wide range of governmental agencies and many civic and private organizations to report on different aspects of the water problem. The result is an unprecedented series of authoritative statements that are being prepared for publication by the committee itself. Judging by the length of those already issued—ranging from 24 to 72 pages—the completed series can be expected to approach a total of 2,000 pages. This, indeed, is a monumental collection of information.

The Geological Survey provides the basic information about water supplies and demand. The Department of Agriculture has prepared three of the reports on subjects of especial interest to conservationists.

One study, on *"Land and Water Potentials and Future Requirements for Water,"* contains highly significant projections of the nation's requirements for agricultural products and expected shifts in land use and water requirements by the years 1980 and 2000.

Another, on *Estimated Water Requirements for Agricultural Purposes and Their Effects on Water Supplies,"* calculates the probable effects of agricultural and conservation programs on water requirements and water yields. It concludes that increased efficiency in irrigation can more than offset expected reduction in downstream flows as a result of land treatment and water-control structures.

The third USDA report gives a preview of the possibilities of *"Agricultural Research as a Means of Meeting Needs."*

Following is a list of the reports either available now or in preparation. Copies can be obtained from the Committee, Room 3206, New Senate Office Building, Washington 25, D. C.

List of Committee Prints

Basic Facts

*1. Water facts and problems—Pictorial charts by Geological Survey.
*2. Reviews of national water resources during the past 50 years—Legislative Reference Service.
*3. National water resources and problems (water supply and demand)—Geological Survey.
*4. Surface water resources of the United States (maps and tables of selected gaging stations)—Geological Survey.
*5. Population projections and economic assumptions—Census and Resources for the Future Data.
*6. State reports on water resources and problems—including Territories and Island possessions.

Projections of Future Demands

*7. Future water requirements for municipal water use—Public Health Service.
*8. Industrial water use—Department of Commerce and Bureau of Mines.
*9. Pollution abatement—Public Health Service.
*10. Electric power in relation to the nation's water resources—FPC, REA, APPA, and EEI combined.
11. Future needs for navigation—Corps of Engineers.
*12. Land and water potentials and future requirements for water—Department of Agriculture.
*13. Estimated water requirements for agricultural programs and their effects on water supplies—Department of Agriculture.
14. Future needs for reclamation in the western states—Bureau of Reclamation.
15. Future needs for flood control—Corps of Engineers.
*16. Flood problems and management in the Tennessee River Basin—TVA.
17. Water-based recreation—National Park Service.
18. Future requirements for fish and wildlife—Fish and Wildlife Service.
*19. Water resources of Alaska—Department of Interior.
*20. Water resources of Hawaii—Department of Interior.

Techniques for Meeting Demands

*21. Evapo-transpiration reduction and phreatophytes—Forest Service and Geological Survey.
*22. Weather modification—Weather Bureau and Dean Eberle.
*23. Evaporation reduction and seepage control—Bureau of Reclamation.
*24. Water quality management—Public Health Service.
*25. River forecasting and hydrometeorological analysis—Weather Bureau.
*26. Saline water conversion—Department of Interior.
*27. Application and effects of nuclear energy—Atomic Energy Commission.
*28. Agricultural research as a means of meeting needs—Department of Agriculture.
29. Costs of future reservoir storage—Staff report based on information from Bureau of Reclamation and Corps of Engineers.
*30. Present and future means for improved re-use of water (waste water salvage, etc.)—A. Wolman Associates.
*31. The impact of new techniques on integrated multiple-purpose water development—Ackerman & Associates.
32. Water supply-demand relationships—Resources for the Future.

*Those now printed and available marked by asterisk.**

Field Notes

FOREST PRODUCTS LABORATORY CITED

The forest industry paid tribute to the Forest Products Laboratory at Madison, Wis., June 2, by presenting plaques and citations at ceremonies commemorating its golden anniversary.

The Laboratory, founded by the Forest Service and operated in cooperation with the University of Wisconsin on the University grounds, first opened June 4, 1910. Research at the Laboratory led to the design used in most of the prefabricated houses today, the first buildings using laminated arches, a water resistant glue, and insulation boards.

Visitors at the open house saw many of the projects now under way to make wood resistant to decay, fire, warp, and shrinkage; pulping processes that make use of hardwoods and logging left-overs; and a slicer that cuts logs into boards without sawdust.

In addition to awards presented by industry, the Laboratory received the U. S. Department of Agriculture's distinguished service award for "pioneering and maintaining visionary planning, sound execution of research, and development of processes resulting in greatly expanded and more efficient use of forest products."

VERTICAL SOIL MULCHER IS SUCCESSFUL

Growers looking for new ways to combat the old problem of soil compaction may find the vertical mulcher an effective tool. The mulcher breaks up hardened soils and lays channels of mulch in the ground. Soils experts of the University of California at Davis, who have been testing the machine since 1956, believe these channels of mulch will hold the subsoil open, increasing water penetration and encouraging root growth into the compacted area, which ultimately means better crops.

B. A. Krantz and James Vomocil, soils specialists on the Davis campus, reported that in one test they established alfalfa plots on three areas: one vertically mulched, one subsoiled without mulching, and one untreated. The respective yields in a September cutting were 2,420, 1,525, an 1,470 pounds of dry matter per acre.

Other tests indicated that considerably more water from irrigation penetrated into vertically mulched plots. Resulting increases in soil moisture content were evident to a depth of nine feet. Calculations from these tests showed that, in the top nine feet, vertically mulched soil contained 14 inches more available water than untreated soil.

The vertical mulcher combines a residue chopper, a blower and a modified subsoiler. Any kind of organic matter can be used for the mulch. The machine has been tested with straw, rice hulls, sawdust, corn stalks and many other materials. It is chopped up and forced by air into the furrow opened by the subsoiler. The subsoiler is equipped with vertical wings that hold the earth back from the furrow until the mulch is in.

MOVEMENT OF CONTAMINANTS IN UNDERGROUND FLOW STUDIED

Results of research by the Geological Survey to help understand the movement of substances dissolved in underground water have been released by that agency.

Water, containing a dye tracer, was flowed through a laboratory sand bed, and the factors that controlled mixing and dilution of the dye with the water were measured and analyzed. The report, "Transverse Dispersion in Fluid Flow Through Porous Media," by Eugene S. Simpson, is a part of a continuing study by the Geological Survey to measure and understand the movement of contaminants that may become dissolved in potable ground-water supplies.

Pending publication by the Geological Survey, a typewritten copy of the report is available for reference at the Survey office, 1242-G General Services Administration Building, Washington, D. C.

NAM CONSERVATION POLICIES ARE LISTED

The National Association of Manufacturers, acting upon recommendation of its conservation and management of natural resources committee, has just accomplished a complete reassessment and codification of its official policy positions in the natural resources field.

The association has the following listing by titles of these policy positions:

1. Watershed improvement.
2. Critical need of industry's awareness of control and usage of water resources.
3. States' water rights.
4. Amortization of water conservation and pollution abatement facilities.
5. State and local participation in conservation of renewable resources.
6. Revision of natural resource statutes.
7. Federal lands.
8. Timber resources.
9. Cost allocations for federal multiple purpose projects.
10. Federal government natural resources organization.
11. Electric power development.
12. Federal Valley Authority.
13. Utilization of natural resources in time of national emergency.
14. Agricultural research.
15. Conservation and management of natural resources—basic policy.

For complete text of any of these policy statements or additional information, contact Daniel W. Cannon, committee executive, National Association of Manufacturers Conservation Committee, 2 East 48th St., New York 17, New York.

NATIONWIDE SURVEY OF WATER USE PLANNED

The Geological Survey of the Department of Interior plans to conduct an inventory of water use in the United States in 1960.

Increasing demands for water are approaching the limit of clean fresh water that is readily available at all times, although large quantities of water are still unused because they occur at unwanted times and places. To keep track of increasing demands, the Geological Survey is bringing up to date similar inventories made in 1950 and 1955.

The new inventory defines the present balance between supply and demand, which becomes more critical as demands increase. The inventory will be made by field personnel as part of their job of investigating the quantity and quality of the Nation's water resources.

Water use will be compiled in six general categories: (1) public supply; (2) self-supplied industrial; (3) steam-electric utility power plants; (4) irrigation; (5) rural domestic; and (6) water power. These data will be tabulated by source-groundwater or surface water—and by location of use, such as by States and by groups of river basins.

GOODYEAR ANNOUNCES NEW AWARDS PROGRAM

The Goodyear Tire & Rubber Company has announced the eighth nation-wide Soil Conservation Awards Program to run for 12 months, starting May 1, 1960 and ending April 30, 1961.

According to A. H. Settle, director of the program, announcements have been mailed to all soil conservation districts. Districts are encouraged to enroll promptly in the new program.

The real purpose of the program is to provide each district with a measure of their activity for the governing body. Each competing district will be provided with work records on which they can itemize their efforts for the year. Soil conservation districts have been divided into competing units and the winners in each unit will receive a Grand Award and a First Place Plaque. An all expense trip to Arizona awaits one district supervisor and the outstanding farmer in the winning districts. While in Arizona, winners will stay at the Goodyear Farms at Litchfield Park.

SOCIETY RECEIVES NEW FILM FROM CATERPILLAR

Caterpillar Tractor Company has provided the Soil Conservation Society of America with a copy of the movie *"Water Bill USA,"* which was premiered at the 7th Annual Watershed Congress in Washington, D. C., in mid-April.

R. M. Woodbridge, general supervisor, Market Division for Caterpillar Tractor Company, has stated, "I hope this copy of *"Water Bill USA"* willl serve some of your organization's promotional needs. We fully recognize it will be impossible to meet all your obligations with a single film. We would call to your attention, however, the fact that many Caterpillar dealers will have this film available and will be happy to provide it for showing in their respective areas."

The Society's copy of the film may be secured by writing to the office in Des Moines at 838 Fifth Avenue, and indicating the dates on which you would prefer to use it. It is a 16 mm. sound film.

"TIPS FOR TOURS"

Reported by Darnell M. Whitt

A GREAT MANY READERS of the JOURNAL OF SOIL AND WATER CONSERVATION are called upon to plan and conduct tours. Recently I had occasion to review a list of *"Tips for Tours"* prepared by R. Y. (Dick) Bailey, former President of the SCSA. The tips developed by Dick before his retirement from the Soil Conservation Service are so sound and practical I thought others would find them of value.

1. **Plan** your field-study trip in advance.

I always considered it necessary to spend a day in selecting the sites that illustrated the points that I wanted to teach. During this field preparation, I selected the place where the group would be assembled for each field discussion. Plan only what you can cover effectively and comfortably in the time allotted for the field trip. Save something for the next field trip.

2. **Arrange** your people so that they can see what you are showing them and also see you.

Stand far enough in front of the group that you can see all of them and stand so that you can talk directly toward them and at the same time point toward what you want them to see. However, arrange group so sun is not shining in their eyes.

3. **Delay** your discussion until all members of the group are in place.

Particularly with large groups, you need to wait several minutes for them to assemble. As a bad example of showmanship, I was in a group that required a large number of vehicles to transport them. The tour conductor started his discussion at a stop while some of us were still parking our cars. He caustically and discourteously chided the late arrivals for being late. It was physically impossible for all to arrive at the same time. Another discussion leader asked us to walk through a narrow alleyway and keep off his plots. He walked ahead of the group and started talking before half of us had time to assemble. We missed the first part of his discussion because we were courteous enough to stay off his plots.

4. **Get** the attention of people in the group before you begin your discussion.

Wait for all members of the group to assemble and complete side conversations that were started while they were assembling. After a brief period of silence, ask for the attention of the group and then wait until all conversation has ceased.

5. **Speak** out so you can be heard.

It is a matter of common courtesy to speak so that all members of the group can hear you. You quickly lose your people if you don't speak loudly enough to be heard.

6. **Stay** on the subject.

If you've observed all principles outlined above, you should be able to tell people what you are there to see. Tell them as clearly and concisely as you can, and don't ramble—your audience is standing.

7. **Invite** questions.

When you've finished your discussion, ask for questions. Be alert and answer each question promptly and courteously, but briefly. After the first few questions, there usually is a pause, which is a good time to thank the people and move on to your next stop. If you stand there and fish for additional questions, you may get irrelevant questions that will lead you into subjects foreign to the one you have just discussed. When this happens, you lose the interest of most people in the group.

8. **Quit** on time.

If you announced your field-study trip for 1:30 to 4:00 o'clock, be through by 4:00 o'clock. Some of the farmers have cows to milk. All of them want to be through on time. Farmers don't like it any better when you run overtime on Thursday afternoon than you do when the minister goes overtime on Sunday morning.—By R. Y. BAILEY. *(Prior to his retirement in 1958, Mr. Bailey was SCS-ARS Research Liaison Representative in the Southeastern States.)*

Final Arrangements for SCSA Meeting Guelph, Ontario, Canada, August 28-31

For the first time members of the Soil Conservation Society of America will hold their annual convention outside the United States. The Society accepted the invitation of the Ontario Department of Agriculture to convene at the Ontario Agricultural College, Guelph, Ontario, on August 28-31, 1960. Convention hosts will be the Ontario Chapter. Convention headquarters will be the new Physical Education Building with a seating capacity of 2,000.

Registration will commence Sunday afternoon at three o'clock. Your hosts have arranged for a buffet supper from 5:30-7:30—*Longtime Supper*—in the Physical Education Building. The evening concludes with a program featuring band music of the Royal Canadian Air Force Band.

Monday morning will be occupied with registration and the opening ceremonies for the *Fifteenth Annual Meeting*. After lunch in the College Dining Hall, the members will hear leading authorities speak on the theme *Our Base Resources*. The ladies decide on one of: shopping in Hamilton and visit to the Botanical Gardens or a tour of Guelph and a demonstration of fabric printing. The *Upper Canada Buffet* will be served in the Physical Education Building starting around six o'clock. The entertainment for the evening will include a variety program, special recognition to the Boy Scouts, and a male chorus.

The program for Tuesday morning will concentrate on the theme *Resources Research* while the ladies shop in Guelph, or visit various features on the Campus. In the afternoon, the ladies again choose between the two tours as scheduled on Monday. The CONSERVATION TOURS have always been a feature of the S.C.S.A. annual meeting. This year the men, and ladies if interested, will purchase a tour ticket at registration. At the same time they will receive a brief summary of the different tours. These trips will endeavor to show you various conservation projects and some farm specialties like tobacco growing, fruit farming, or dairying. As you return from your tour, the Ontario Department of Agriculture will treat you to a free ONTARIO BARBECUE. The entertainment for the evening will feature a HIGHLAND PIPE BAND complete with Kilts, Sporrans, Bagpipes, and Dancers—a SCOTTISH THEME you will long remember.

The Annual Business Meeting is scheduled for Wednesday morning; the theme for the afternoon program is *Effective Land Resource Use* featuring discussions on economics and conservation at work. As most of the local stores are closed all day, the ladies will be welcomed to visit Macdonald Institute where our girls study the science of home economics. If enough people are interested, a nearby woolen mill will open their retail store.

The Children's Program is designed to interest our young conservationists in activities according to age groups. It is expected that the Athletic Field House will be available for indoor games and dancing; the swimming pool is always a popular place; other activities include ball games, golf, tennis, and horseback riding.

For the Campers or those with house trailers, ideal camp sites are located near Guelph—one 16 miles out and another 22 miles. These people will be able to eat all their meals at the College but be sure to register and contact the camp director because the choice sites are always at a premium at this time of year.

Those attending the *Shakespearean Festival* should make their own arrangements with the office in Stratford, Ontario. This feature is so popular in Ontario that only a few tickets are available the night of a show. If you cannot get tickets then consider spending Wednesday evening at the *Canadian National Exhibition* in Toronto.

If you decide for any reason to stay over to Thursday, it will be a very simple procedure to arrange for you to retain your room and also provide meals. The last meal at the College will be breakfast Thursday morning.

We urge you to acquire your CANADIAN MONEY or travellers' cheques in Canadian funds through your local bank. At the time of writing Canadian money is almost at par with the American dollar.

Prices and Weather are always reasonable in Guelph. Except for the free barbecue on Tuesday, the other evening meals will cost around $2.00, lunches and breakfasts 75c to $1.00; tours $1.00 to $2.00. Lodging in the College dormitories is most reasonable. For the last week in August the mean daily high is 75 degrees F. and the mean low 53 degrees F.

Late word from the Ontario local arrangements committee indicates 721 advance registrations. The committee advises that all dormitory space has been reserved. Requests for hotel and motel accomodations may still be made and will be handled promptly by the convention officials.

The local arrangements committee of the fifteenth annual meeting are shown in a recent planning session.

REMINDERS

(1) To be assured of accommodation advance register immediately, sending a completed registration form to:

Soil Conservation Convention
Ontario Agricultural College
Guelph, Ontario, Canada

All advance registrations will be acknowledged and the accommodation that has been reserved for you will be indicated. Confirm your reservation with the hotel or motel by making a deposit. No confirmation required if we notify you that lodging is being held for you at College Dormitories. Linen and bedding are supplied for those in College Dormitories.

(2) Campers should register and contact:

G. M. Coutts, 27 Dickson Street
Galt, Ontario

to be assuredd of a camp site with modern facilities.

(3) If you would like to attend the Shakespearean Festival, please make your arrangements directly with:

Stratford Shakespearean Festival
Stratford, Ontario

(4) The Local Arrangements Committee regret that they cannot act as a booking agent.

(5) Bring your Chapter Banner.

(6) If you are traveling by commercial airlines, let us have your flight details so we can arrange transportation to Guelph.

News Notes

Secretary's Column

How much progress is being made in soil and water conservation? You are probably asked this question quite frequently. To completely answer the question is extremely difficult because it involves many groups, agencies, and individuals including the farmer and rancher applying the practices.

Each agency involved in soil and water conservation work prepares a yearly summary and these generally show progress. Latest summary I have seen is the one in Agricultural Statistics giving accomplishments in soil conservation districts, watersheds, by individual farmers in the agricultural conservation program, by the Forest Service and others having to do with conservation. This summary shows progress!

If you are allergic to such reports perhaps the question of progress can best be answered by a visit with field men of the Soil Conservation Service, by talking with farm foresters, county agricultural agents, county ASC committeemen, field men for the Bureau of Indian Affairs or the Bureau of Land Management. These men, together with those from state soil conservation committees and local soil conservation district supervisors are all enthusiastic about the work in soil and water conservation in progress under their jurisdiction. They will spend considerable time showing and telling visitors about their work. All are extremely busy, many with a back-log of work that will carry them into another year. They have figures to justify public expenditures made.

In the period of a year your executive secretary probably meets more of these groups than the average SCSA member . . . and I always feel encouraged about the progress after such visits.

During the past few weeks I have visited a watershed project in Texas with officials of the North Texas Chapter, and with officials of the Forest Service and Forest Experiment Station for the North Central Region. Space prevents going into detail but it was easy to note progress made in recent months. We all admit there is still a huge task ahead to reach the ultimate in soil conservation on the land. On the other hand we do not need to be ashamed of the work to date.

You may have noticed the small "R" on the cover page of the *Journal*. This indicates the title has been registered with the U. S. Patent Office and is thereby protected. This is a rather lengthy procedure and the *Journal* is one of the few publications of societies in the agricultural and resource field to be registered.

H. Wayne Pritchard,
Executive Secretary

DATES TO REMEMBER

Sixth Annual Conference, Conservation Education Association. State University Teachers College, Oneonta, N. Y., August 15, 1960. Discussion area will center on "Conservation Education Programs for Youth Groups." The program is being developed by the Girl Scouts, Campfire Girls, Boy Scouts, 4-H, Nature Centers for Young America, and the Association.

Additional information may be obtained from C. W. Mattison, president CEA, 10014 Greenock Road, Silver Spring, Maryland.

1960 Soil Conservation Field Days and National Plowing Contest, September 21-23, Sioux Falls, South Dakota, sponsored by the South Dakota Association of Soil Conservation Districts, Radio Station WNAX and the Sioux Falls Chamber of Commerce. Featured during the three-day event will be many conservation demonstrations, new farm equipment displays, a challenging plowing contest and crop and machinery displays. For further information write to Gordon Olson, Manager, Sioux Falls Chamber of Commerce, Sioux Falls, South Dakota.

Western Resources Conference—Theme: Water Measuring and Meeting Future Requirements. Conference will be held on the University of Colorado Campus, Boulder, Colo. It is sponsored by University of Colorado, Colorado State University, and Colorado School of Mines. For additional information, write: Committee on Western Resources, New Chemistry Building, Room 305, University of Colorado, Boulder, Colorado.

President's Column

Have you gathered up those road maps, called a family council and decided on the routes to take and the time that you will spend going to and from the fifteenth annual meeting of the Soil Conservation Society of America to be held August 28-31 at the Ontario Agricultural College, Guelph, Ontario, Canada? The theme for this year's meeting, "New Technologies in Land Resource Use," will give you a good opportunity to learn of new methods and procedures in soil and water conservation, observe how things are done in other areas, visit with old friends, and become acquainted with new friends.

Husbands, don't fail to show your wives the ladies' program for the fifteenth annual meeting of the Society. I am sure the "teakettle engineer" in your home will appreciate the attention given to recreational facilities and activities for children and teens. Great possibilities exist for side trips that will appeal to almost any interest and will help make this a long-remembered, ideal family vacation.

Reports indicate excellent annual chapter meetings. As chapter members, I cannot urge you too strongly to participate actively in your chapter projects and activities. By so doing, all have an important part in achieving our Society's objectives and goals.

The Soil Conservation Society of America is a vigorous, growing organization. The great strides since our organization as a Society continue and we move forward in advancing soil and water conservation and the science and art of good land use. As members of the Society, you are dedicated to the improvement and conservation of our God-given heritages of soil and water—resources essential for man's survival and living.

We have a tendency to become slaves to efficiency, bigness and supermanagement. Let us resolve to improve our soil and water resources and use them wisely. Let us attain a better perspective of the real values involved and strive for the coordination of all agencies and efforts which claim as their purpose the conservation and

(Continued on page 195)

CHAPTER NEWS

Korea Chapter. Charles D. Crocker, chairman Korea Chapter, SCSA, reports many outstanding activities of that group held during the spring. Members of the Society have developed or assisted with the development of an active national program. Crocker mentions that Carl R. Fritchie, Walter Nixon, and Kim Yung Joon and Kim Hak Soo, Society members, have been most active in the program that culminated in a national Soil Conservation Day with Plantings. Six thousand people, most of them government employees, attended the ceremonies and after which they helped cultivate and seed 100 acres of denuded land. This was covered by all press services in Korea.

Crocker states that the chapter will soon furnish the JOURNAL with information on the "spot seeding" technique they have introduced which cost approximately $3.47 per acre and replaces the old Japanese technique which cost an average of $230 per acre.

On Foreign Volunteer Planting Day, March 26, fifteen active members of the Korea chapter were technical guides and instructors. The workers planted seed, seedlings, and carried out fertilization practices with the assistance of the Korean Bureau of Forestry. More than 400 Americans assisted in this special day that was adequately covered by the Korean press. This Foreign Planting Day was in addition to the National Soil Conservation Day where a summer project was carried out with Korean government employees.

The West Tennessee Chapter met in Jackson, Tennessee, on April 27, with about 60 members present. The chapter took official action approving the Society's building fund and setting as a chapter goal a minimum of $2.00 annually per member for at least 75 per cent of the membership during the five year building period. R. D. Fisher, Milan, Tennessee, was appointed chairman of the building fund committee.

High Plains Chapter met on May 6 in Colby, Kansas, with 20 members present. Considerable business was transacted and Leon Trumbull of the National Association of Soil Conservation Districts was introduced as the speaker of the evening.

South Central Nebraska Chapter held its May meeting on the 16th in Lexington, Nebraska. The chapter has several committees at work and they are carrying on an active program in membership development and supporting the Society's building fund. The chapter now has 97 members.

First Annual Meeting — Kansas Chapters. The seven chapters of SCSA in Kansas have formed a state council of chapters with Howard Hughes of Hays as chairman, Virgil J. Quint of Hays as secretary. The group held its first state wide annual meeting May 20-21 at Hays with an extensive program.

The theme of the first day's meeting was *"Conservation is Everybody's Business"* and those appearing on the program included Harold E. Jones, director, Division of Extension, Kansas State University; Morrie A. Bolline, state conservationist, SCS, Salina; Rev. Loyal Miles, First Methodist Church, Hays; C. R. Hubbard, president, Guaranty State Bank, Beloit.

B. K. Geraghty, council member, Great Plains Region, reported on activities of the parent society while William Bork, director of information, The Farmers Cooperative Commission Co., Hutchinson, moderated a TV and press panel on the meeting theme.

Honorary members and fellows of the Society from Kansas: Howard Miller, Clifford Hope, R. I. Throckmorton, Fred J. Sykes, were recognized at the evening banquet. L. E. Schumacher, vice-president, Dean Machinery Co., Kansas City, Missouri, spoke at the banquet on the subject, *"There is No Water Problem."*

Theme for the second day was *"Research in Conservation"* and those appearing included W. S. Chepil, soil scientist, Wind Erosion Laboratory, Manhattan; F. W. Albertson, Professor of Botany, Fort Hays; W. W. Duitsman, superintendent, Fort Hays Experiment Station.

Missouri "Show-Me" Chapter. John H. Gibson, chairman of the chapter for 1960, has recently transferred to Dayton, Ohio, and the new chairman is T. E. Presley.

The North Carolina Chapter will hold its annual meeting at Carolina Beach June 24-25. The chapter is having an active year under the chairmanship of J. B.

STUDENT CHAPTERS FORMED IN THREE STATES

Three new student groups have joined the rank of student chapters or branches of the Society. The largest is the new student chapter at Virginia Polytechnic Institute, Virginia Tech Station, Virginia. Forty-two students petitioned the council to organize a chapter at that institution. The council has approved the new group and Mr. George H. Comer is serving as temporary chairman. Bernard L. Parsons, associate professor, Department of Agricultural Engineering, at Virginia Polytechnic Institute, Blacksburg, Virginia, is the faculty advisor. A picture of the new group is herewith.

Another student chapter was formed at the University of Tennessee, Knoxville, Tennessee, with Mr. James Lee Menees of Knoxville serving as the temporary chairman. Ten students signed the petition but it is anticipated their membership will increase in the near future.

At Southern Illinois University, Carbondale, Illinois, nineteen students banded together and petitioned the Egyptian Chapter to form a branch of that group at the Southern Illinois Institution. The organization meeting was held on April 12. George E. Smith, chairman of the Egyptian Chapter, has worked diligently with others to organize this group. LeRoy W. Hacker is the student leader.

Watts and publishes an outstanding chapter newsletter on a bi-monthly basis. The newswsletter is printed, mailed at bulk postage rate, and contains considerable information about North Carolina members.

Georgia Chapter held its annual meeting at Rock Eagle Park, Eatonton, Georgia, May 13-15. Theme of the meeting was *"Water in Georgia's Expanding Economy."* Families were invited and many used the facilities of the park for the weekend. The Soil Conservation Society of America was represented at the meeting by president Elmer L. Sauer of Urbana, Illinois.

Mississippi Chapter. The Water Resources Management Committee of the Mississippi Chapter, SCSA, met in Jackson on March 24 to discuss the watershed program in that state. C. H. King of the Mississippi Road Supply Co., talked on the subject, *"Viewpoint of Equipment Representatives,"* and referred primarily to the earth-moving job that is carried on by contractors in regard to the small watershed program. He urged that more contractors consider conservation work, but that such work, to attract contractors, must be a profitable venture. Mr. King related that some of the small contractors have experienced difficulty in bidding on watershed work, figuring equipment costs involved in the job, working on the administrative problems relating to the contract.

C. H. KING

He concluded that the heavy equipment used in earth-moving in agricultural projects is essential to the modern soil and water conservation programs. Without this equipment such programs would be impractical.

The Mississippi Chapter is also planning a 12-day sight-seeing bus tour to the 15th annual meeting in Canada, August 28-31. Costs include transportation, hotel and incidentals.

Others appearing on the water resources management committee program included S. A. Thompson, the Honorable Ross Barnett, Governor of Mississippi, Gerald E. Ryerson, Director Administrative Services Division, SCS, Washington, D. C., and Carl Brown, Assistant to Administrator for Watersheds, SCS, Washington, D. C.

Hoosier Chapter. The Hoosier Chapter has recently announced additional standing committees on projects, publicity, conservation materials, home for SCSA, exhibits committee for Ontario, nominations and election. In addition the chapter has divided the state and appointed area representatives. They are also having a campaign for all members of the Hoosier Chapter to display the wall certificate that is available from the parent organization in their offices.

The Hoosier Chapter has issued an index of proceedings for the annual meeting held on January 8, 1960. The proceedings consists of 32 pages of mimeographed copies containing the papers delivered at the meeting. The mimeographing and related expenses were covered by a registration fee for the event.

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Excellent weathering qualities — retains 50 to 75% of tensile strength when wet.

Selvage edges and center yarns (where material is stapled to ground) mildew-treated and reinforced for longer life.

Holds mulch snugly in contact with soil through the growing season.

Does not have to be removed.

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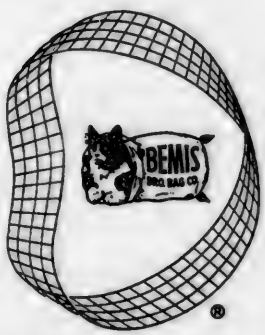
Economical—costs approximately 4¢ per square yard.

Write on your letterhead for a sample roll of MULCHNET for testing and also for a copy of EROSION CONTROL NEWS, loaded with information about the numerous benefits of MULCHNET.



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Pulls wider hitches of tools, 6-9 plow bottoms depending on soil conditions.
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Works all day on a tank of low cost furnace oil.

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13,000 lb. drawbar pull (about twice as much pull as most 4-5 bottom wheel tractors) • 5 speeds forward, 4 reverse—25% more lugging ability than ever.

Ask the man who farms with a Cat Diesel Tractor. Ask your conservation contractor about crawlers. Men who make their living doing the toughest jobs—earthmoving, land clearing, heavy-duty custom work—pick Caterpillar Diesel Tractors.

You've a tough job to do, too—so take it from them when selecting a crawler—and you'll pick the new D4! See your Caterpillar Dealer for complete facts and a demonstration on your farm—in your soil conditions—with you at the controls! And write us for free literature on the new D4C—a big step up in farming.

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(Continued from page 191)

improvement of our renewable natural resources.

We appreciate a recent invitation to visit the Fifth National Jamboree of the Boy Scouts of America to be held on a large ranch near Colorado Springs, Colorado, July 22-28, 1960. We commend the Boy Scouts for their earnest and sincere endeavors in conservation activities and wish them every success in this year's jamboree, which is a highlight activity of scouting's Golden Jubilee Year. We welcome the scouts as teammates in this struggle to achieve soil and water conservation on all of our natural renewable resources.

You will be interested in knowing that Wallace E. Akin is representing the Soil Conservation Society of America at the Tenth General Assembly of the International Geographical Union and the Nineteenth Geographical Congress which are meeting simultaneously in Stockholm, Sweden, August 6-13, 1960. Also, Dr. Edward Graham represented the Society at the meeting of the International Union for Conservation in Warsaw, Poland, June 15-24, 1960.

Have you made an honest attempt to secure a new member for 1960? One of our southern members, Georgia Chapter's Vice-President, Roy Grizzell, has secured over 60 new members in 1960. Who can top Roy's record? Incidentally, I urge all of you to contact your chapter officers and see if there are any members in your area who have not paid their 1960 membership dues—if so, talk to them, let us know what their problem is and see if we can have 100 per cent conservation of membership in each chapter.

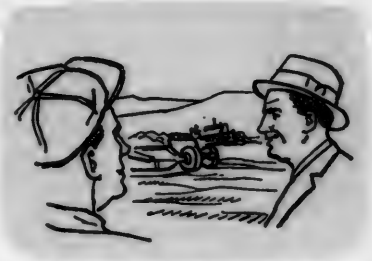
When you receive your ballots for election of officers and councilmen, show that you are good conservation citizens and, following the directions, mark your ballot and send it in. Your vote counts! Remember, the officers and councilmen are your representatives in the running of the Society. Through them you have a voice in all Society affairs.

We welcome Walter E. Jeske who will become Editor of the JOURNAL OF SOIL AND WATER CONSERVATION and Assistant Executive Secretary for the Society effective July 1, 1960. He will welcome your articles, comments, news notes, and items of interest. Mr. Jeske is looking forward to meeting those of you who come to Guelph.

See you at Guelph!

ELMER L. SAUER
President

Bill Smith, contractor, speaks on used equipment!



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"But now things are a lot different. When I buy used equipment, I buy from a Caterpillar Dealer.

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A "Bonded Buy" up to $10,000 on used Caterpillar equipment—your guaranteed assurance of satisfactory machine performance and on *all* parts of the machine during the guarantee period . . . and it includes labor, too. Also a "Certified Buy" and a "Buy and Try" class of machines that give you full value for the money.

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BEST BUYS IN NEW AND USED EQUIPMENT

NEWS OF MEMBERS

LARRY K. MAYS

Larry K. Mays, chief of the Division of Operation for the Southern Region of the Forest Service, on May 2, 1960 became coordinator of the nationwide Civil Defense program of the Forest Service with headquarters in Washington, D. C.

L. G. Samsel, for many years with J. I. Case Company, Racine, Wisconsin, is now retired and has started his own consulting service relating to farm machinery and farm practices throughout the United States and Canada. His address is 3337 North Elmwood Drive, Racine, Wisconsin.

Louis H. Wilson, secretary and director of information for the National Plant Food Institute, Washington, D. C., was cited by the National Association of County Agricultural Agents on April 27 for his *"untiring efforts, valued counsel, and advice and productive service in the improvement of American agriculture."* The citation was the first award presented in the 44-year-old history of the Association.

Edd Roberts, Oklahoma State University extension soil conservationist and one of the originators of land judging work, reported that Oklahoma's ninth annual international land, pasture and range judging contest, held April 28-29 in Oklahoma City, drew 675 contestants from 26 states and 16 foreign countries.

The Thomas L. Stokes award committee on May 3 presented its first annual trophy to a newspaper writer for service to research conservation. The recipient was **Leonard Hall** of Caledonia, Missouri, Society member, nature and country columnist for the St. Louis Post-Dispatch and nationally known wildlife photographer and lecturer. The Stokes Committee, a memorial to the late Thomas L. Stokes, consists of 150 distinguished Americans in the Congress, in communications, and in other walks of life. Society members know Mr. and Mrs. Hall as the operators of the Possum Trot Farm that has been restored to high fertility.

Numerous Texas members of the Society have recently received certificates of merit and cash awards for their outstanding work in soil and water conservation for the Soil Conservation Service. They include: **H. N. Smith, Phillip M. Price, Homer A. Taff, Hayward A. Moncrief, Jr., Gerold L. Lanman, R. C. Barnes, Jr., N. P. Stephenson, John T. Kincaid.**

Ervin L. Peterson, Assistant Secretary of Agriculture, received the *"1960 Watershed Man of the Year"* award at the annual banquet of the Seventh National Watershed Congress in Washington, D. C., on April 19, 1960. Mr. Peterson is an honorary member of the SCSA.

William G. McGinnies, director of the Central States Forest Experiment Station, Columbus, Ohio, has recently been recognized with the Medallion of Merit Award, presented by the University of Arizona on its 75th anniversary.

Dr. McGinnies was recognized for his work as a student, alumnus, teacher, research worker, and administrator.

Wallace E. Akin, head, Department of Geology and Geography, Drake University, Des Moines, Iowa, will represent SCSA at a symposium on agrarian geography, at Horsens, Denmark, July 28 to August 4. He will then attend the 19th International Geographical Congress at Stockholm, Sweden, August 5-13. Dr. Akin has received a travel grant from the National Science Foundation.

Two Society members were among those recognized recently by the American Motors Conservation Awards Program and include **G. Claire Herting,** Norwich, N. Y., for his work in the Upper Susquehanna Watershed Association, and **Cyril Crawford,** Winona, Minn., for his work with soil conservation districts.

M. Wayne Casey, Peterson, Iowa, was named a farmer member of the Iowa State Soil Conservation Committee, effective July 1, 1960, to succeed **George Eason,** Le Mars, Iowa, who resigned to accept an assignment as chief of party for an agricultural team assigned to Laos. Mr. Eason will work for International Voluntary Services under contract to International Cooperation Administration.

Charles M. Goethe, Sacramento, California, received one of six conservation service awards given by the Department of Interior. Mr. Goethe's award gave recognition to his efforts in developing an effective program of nature interpretation in the National Park System.

Donald A. Williams is shown accepting a folder of water conservation stamps from L. Rohe Walter of the Post Office Department during the National Watershed Congress in Washington, D. C., April 18, 1960. The SCSA, one of the Congress sponsors, received a folder of stamps autographed by Postmaster General Summerfield. The folder will be placed in the Society archives.

R. Earl Storie will retire July 1 after 39½ years of service with the University of California. He is a professor of Soils and Plant Nutrition. He is also Soil Technologist in the California Agricultural Experiment Station, and has been in charge of Soil Survey for the past 20 years. He is chairman of the California Soil Correlation Committee and consultant in the California Soil Vegetation Survey.

Professor Storie is best known as the originator of the Storie-Index for rating soils and other land classification endeavors extensively used in California and other countries of the world.

Professor and Mrs. Storie plan to attend the Fourth International Congress on Irrigation and Drainage to be held in Spain in June, returning to the United States in time for the International Congress of Soil Science in Madison, Wisconsin, in August.

Cal R. Henry, member of the Society's Development Fund Board, has retired as manager of Oliver Corporation's Washington, D. C., office. Mr. Henry will enter into private business in the field of consulting, public relations, government and export sales, representing the manufacturer. He will continue to represent Oliver in Washington, D. C., and will have offices in his name in the Shoreham Building, 806 15th Street, N. W., Washington 5, D. C.

The color cover of the June issue of the *American Forests* magazine featured **Dr. Hugh H. Bennett,** former chief of the Soil Conservation Service, and founder of SCSA. The picture showed him at work in his garden at his home in Falls Church, Virginia.

Now . . . A Proven Way to Stabilize Critical Waterways

New S.C.S. Development Holds Soil in Place Until Vegetation Takes Over

By R. V. D. Broach
Soil Erosion Control Specialist
Ludlow Textile Products

Now you can put an end to seed and soil washouts by protecting waterway channels with Soil Saver — a heavy jute mesh that prevents erosion until grass or other vegetation is firmly established.

Soil Saver offers many advantages that make it the most practical aid yet developed for the establishment of turf in critical waterways.

Excellent Mulch

Soil Saver comes in easy-to-handle rolls, 50-and 75-yards long and four feet wide, with openings about 1″ square. Pressed into the soil it provides over 3000 erosion "check-dams" per yard. Soil Saver's heavy jute strands provide an excellent uniform mulch, and add more than two tons of organic matter per acre. Because of its heavy open mesh construction, Soil Saver cannot be lifted by wind, water, or growing grass.

If you have seeded critical waterways, diversion terraces, spillways, drainage ditches, dikes or dams, again and again, only to see your top soil washed away by heavy rains, you can now seed these areas with complete confidence that the job will be final and effective.

Outstanding Results

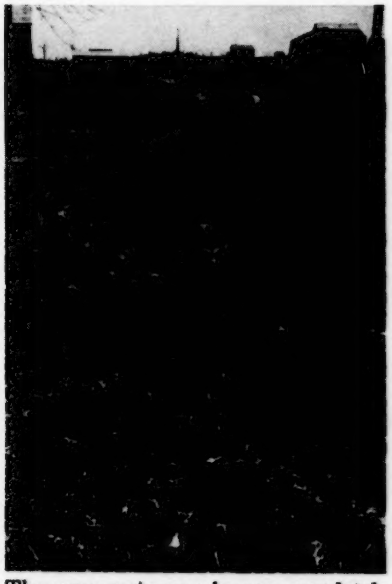
Soil Saver has been thoroughly tested by soil conservation groups for the past two years. It has made successful plantings possible on critical bankings and waterways where other erosion deterrents had failed. Many agronomists are agreed that seeding or sprigging with Soil Saver is the most practical method yet found for establishing vegetation in areas subjected to concentrated water flow. Now, because both terraces and outlets can be constructed *at the same time*, there is no need to temporarily divert water.

Once Soil Saver has been laid, there's nothing to do but wait for the grass to take hold. No maintenance is required. Soil Saver conforms to every accepted agronomic practice.

Send coupon today for free Soil Saver sample and complete installation directions.

Despite several attempts to grow erosion-resistant grasses, repeated washouts turned this Maryland farm waterway into a series of deep gullies.

After regrading and shaping, two widths of Soil Saver were laid to hold soil in place. Soil Saver kept heavy rain from washing out the channel before vegetation was established.



The same waterway is now completely stabilized with deep-rooted vegetation. By the time grasses take hold, Soil Saver has decomposed adding valuable mulch to the soil. (S.C.S. Photos)

Ludlow

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LUDLOW TEXTILE PRODUCTS
NEEDHAM HEIGHTS 94, MASS.

Please send me free Soil Saver sample and installation directions.
My particular problem is:.....
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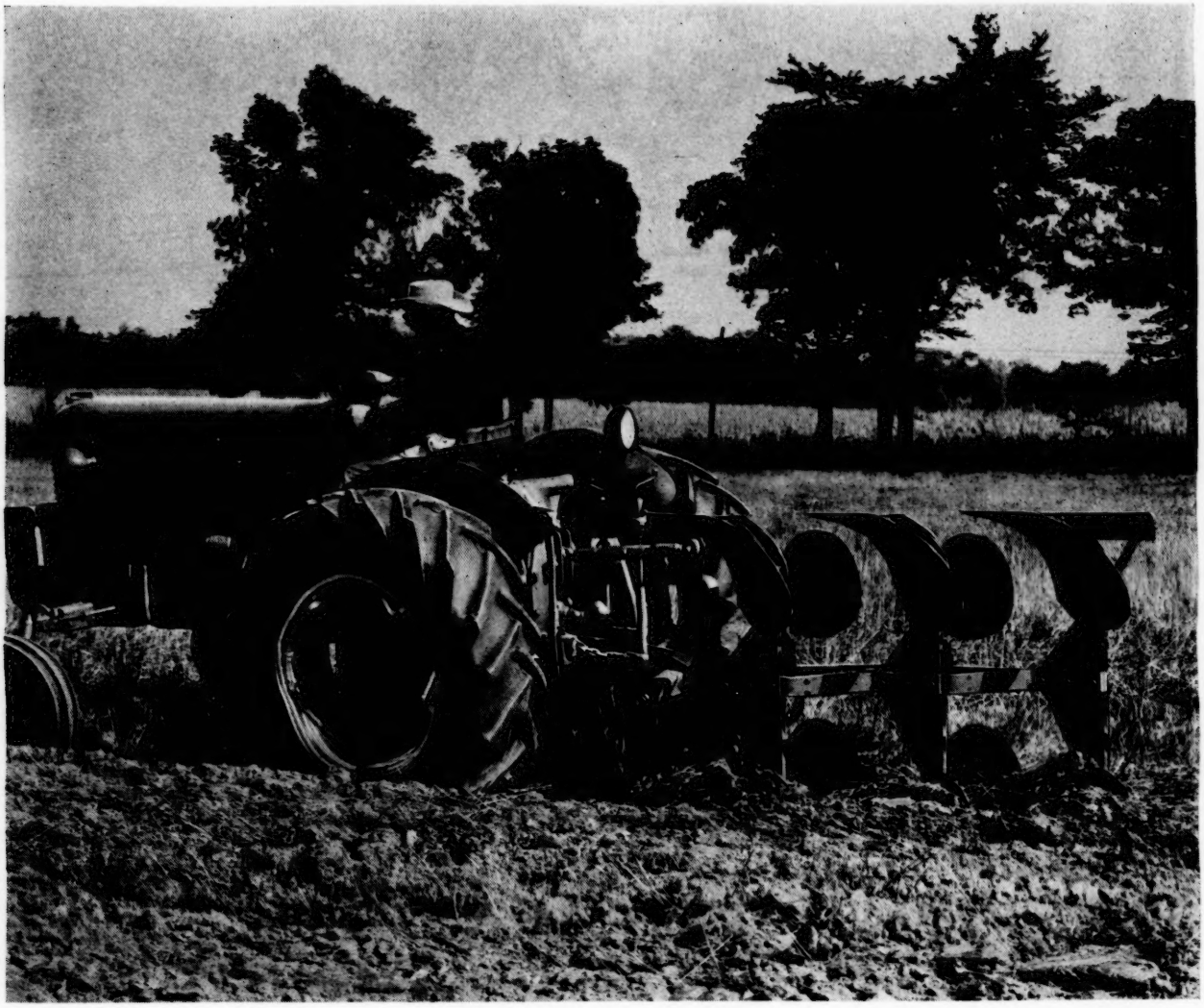
Name.....*Title*.....

Route.....*Box*.....

Town.....

State.....



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Our hats are off to the SCSA. The knowledge and practices of good soil and water conservation are of utmost importance to agriculture.

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So again, from the world's largest manufacturer of tractors and self-propelled combines, we bid you welcome.

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